AGRICULTURAL ENGINEERING

AUGUST • 1956

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Liquid Fertilizer Metering Hose Pump Provides Uniform Application

•

Integration of Materials Handling Systems Presents Challenge to Engineers

•

Prefabricated Panels Offer Diversity in Farm Building Construction

•

New Method Detects Drilling Deflection in Deep Water Wells

•

Engineers Investigate Use of Mechanical Energy for Weed Control

THE JOURNAL OF THE
AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

3 NEW CASE COLOR FILMS ON FARM MECHANIZATION

Here in three new Case color films is the history of men and machines for the farm . . . the step by step progress from hand harvesting to automatic combining . . . the color and romance of the age of steam . . . and the behind-the-scenes story of the launching of the tractors of tomorrow.

You'll want these films for the education of your students, the entertainment of both young and old. See your Case dealer for prints . . . arrange now to show these films to all your students next fall. You are welcome to make use of these and other Case teaching aids—movies, booklets, slide films, posters, study outlines, reprints. J. I. Case Co., Racine, Wis.

"Centennial of Farm Mechanization"

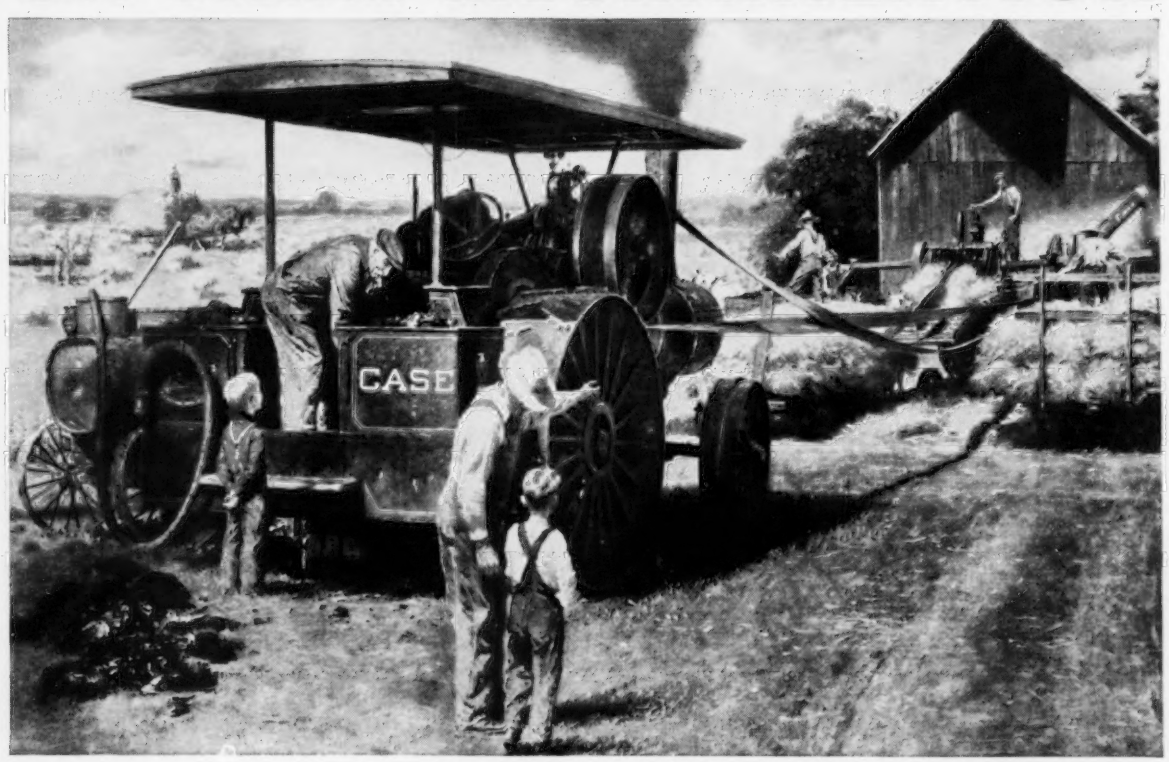
Machines and methods from the past 100 years as shown at Michigan State University's "Centennial of Farm Mechanization" and "Land of Plenty" pageant at Lansing, August 15-19, 1955. Additional operational footage from the extensive Case film library.

"When Steam Was King"

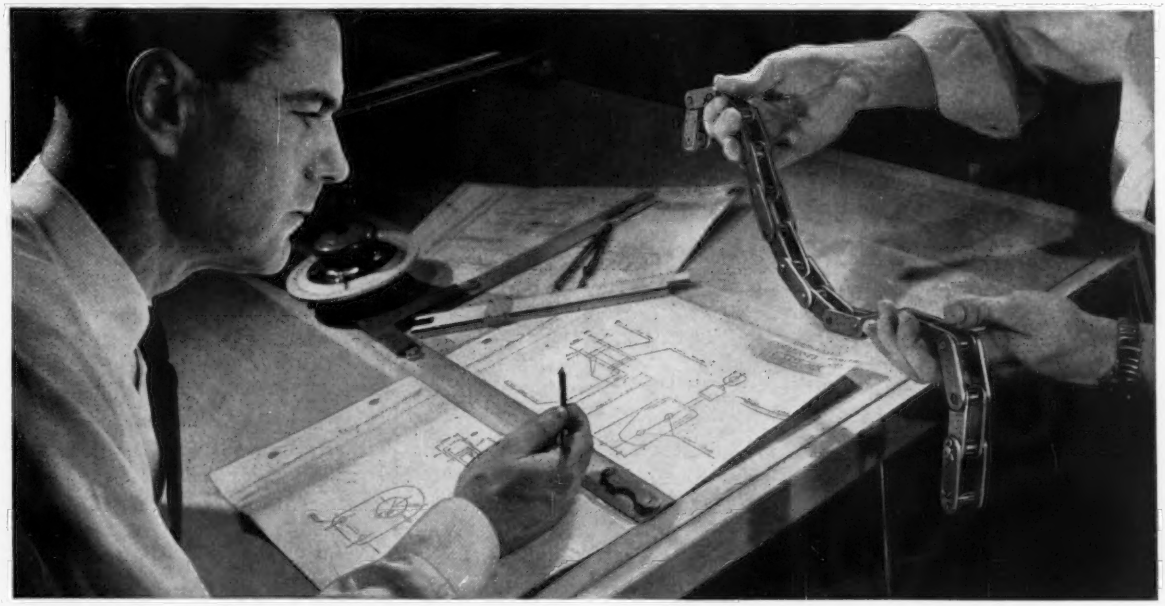
Look at the picture below and remember threshing time when you were a boy, eager to be part of the crew . . . let your audiences relive the days when steam was king . . . show your students the romance and excitement of the steam age. See steamers on parade!

"Operation Tractor Launching"

How a major manufacturer introduces a new tractor to his own organization . . . trains service men . . . and finally, presents it to dealers and farmers in field demonstrations is told in this newest of Case films, first of its kind in the industry.



Designers:
Need special attachments for chain?



LINK-BELT makes a broad selection and offers unmatched background in developing new designs

WHERE roller chain must be specially adapted for conveying, it pays to be as critical of attachment design as you are with the chain itself. That's why Link-Belt experience plus unmatched engineering and production facilities are so important to you.

For many applications, standard attachments proved on similar jobs are available. For special requirements, our engineers will work with you on the drawing board and in field-tests to see your need satisfied. Whether it's a simple sidebar hole or double-strand support to accommodate slats —long life and ample capacity are assured. In addition, the broad Link-Belt line of ASA single- and double-pitch roller chain and high-quality, low-cost "AG" roller chain provides the specialization you seek to meet all basic requirements.

For complete information on chain, attachments and matching sprockets, call the Link-Belt office in your area.

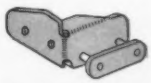
LINK-BELT

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13,962

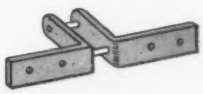
Typical LINK-BELT attachments developed for specific jobs

Used to convey corn on modern two-row picker.



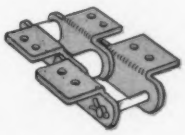
Holds slats for conveying grain or corn into combine cylinders.

Used on gathering chains for corn pickers and forage harvesters.



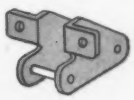
Designed for single-strand elevators on corn pickers.

For interconnecting raker bars to convey hay on forage harvester.



Used with interconnecting slats on combine feeder.

For conveying and elevating, primarily on corn pickers.



AGRICULTURAL ENGINEERING

Established 1920

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"We get four times the wear since we switched to USS MAN-TEN Steel,"

says Leslie Gunning, Gunning Manufacturing Company, Lansford, North Dakota

Mr. Gunning, one of four farming brothers who operate the Gunning Manufacturing Company, is the inventor of the Rol-A-Dam Dammer. This outstanding new tool performs a very vital service in the use and conservation of rainfall.

When Mr. Gunning first developed the Rol-A-Dam Dammer, he designed it of carbon steel. Later he switched to USS MAN-TEN High Strength Steel. "The other steel wouldn't stand up," explains Gunning. "Blades bent, became distorted, wore out. USS MAN-TEN steel met our specifications excellently. With carbon steel, blades on the dammer were pretty well worn out after 300 acres. With USS MAN-TEN steel the blades last 1000 acres or more. We're very content."

USS MAN-TEN steel has proved many times that it has the ability to stand up longer and give better, trouble-free service even under tough abrasive and atmospheric corrosive conditions. Like the other USS HIGH STRENGTH STEELS — USS COR-TEN and USS TRI-TEN "E" — USS MAN-TEN has a 50% higher yield point than carbon steel. It has better atmospheric corrosion resistance and offers superior resistance to wear, impact and fatigue. In vital parts like the blade of this Rol-A-Dam Dammer it can very effectively be used to increase durability without adding to the weight. In addition, USS MAN-TEN High Strength Steel is readily workable.

NOW AVAILABLE: Our "Design Manual for High Strength Steels" contains comprehensive and practical information that you will find extremely useful in designing your product for greater economy and efficiency by the sound use of high strength steels.

For your free copy, write on your company letterhead, giving your title or department, to United States Steel, Room 5398, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
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IN THE LANSFORD AREA, Rol-A-Dam Dammers are in use on more than two-thirds of the farms—including this farm owned by Mr. Floyd Tyler. This unique new tool, which will fit on virtually any cultivator, is of comparatively simple design. It consists of the damming blade, the wheel which is self-tripping, and the frame. As the cultivator moves down the field, the Rol-A-Dam Dammer shapes the furrow into little basins separated by small dams. As Mr. Gunning says, "The purpose of the Rol-A-Dam Dammer is to help control moisture on the farm, to protect fields from wind damage and hold rain and snow right in the furrow."

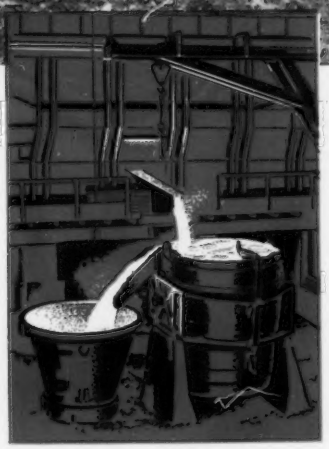
USS MAN-TEN HIGH STRENGTH STEEL

USS

UNITED STATES STEEL

LaBelle discs stay sharp longer...

Many John Deere implements like this Pick-up Disk Harrow are equipped with Crucible LaBelle discs.



. . . *this field advantage 'is built in here!*

When you specify Crucible LaBelle discs, you insure better performance in the field. Here's why:

At Crucible, *disc* steel is as much a special purpose steel as *tool* and *stainless*. In every phase of production, from melting through fabricating, special steps are taken to produce LaBelle quality. One example: grinding is done prior to heat treating to insure a better edge. All this is done by Crucible's specialty steelmen . . . to *build-in* LaBelle's field advantage: a longer lasting edge that performs better in any type of soil.

Crucible LaBelle discs are available for any make of plow or harrow . . . or for any soil condition. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

How Armco ZINCGRIP Tubing Gives Barnyard Equipment Balanced Design

Manufacturers of barnyard equipment are becoming more and more aware of the sales and production advantages gained by giving their products *balanced design.*

That's why agricultural engineers are choosing Armco® ZINCGRIP® Welded Steel Tubing for light structurals, bracing and liquid conveying systems in galvanized steel barnyard equipment.

Because this special tubing is made from Armco ZINCGRIP Steel, it has a full commercial weight zinc coating inside and outside. As the tubing is formed, the outside weld bead is planed off and the zinc coating replaced on the outside seam by a special metallizing process.

Balances Creep Feeder Design

One manufacturer of pig creep feeders tried two other kinds of tubing for canopy supports, then standardized on ZINCGRIP Tubing. Armco ZINCGRIP Steel is used for body of the feeder.

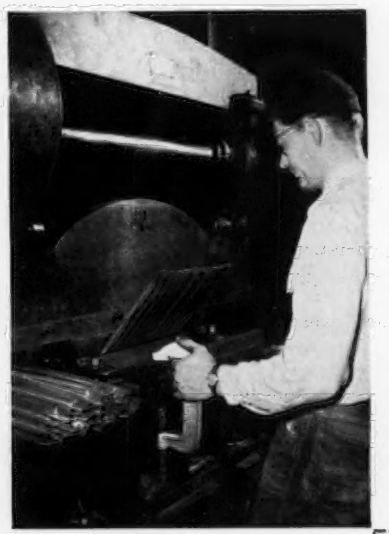
Armco ZINCGRIP Tubing canopy supports keep larger hogs from "muscling in" on expensive starter feed intended for young pigs only. The body of this feeder is also made of Armco ZINCGRIP Steel.

In addition to providing balanced design, Armco ZINCGRIP Tubing meets this feeder manufacturer's rugged service conditions. The canopy and supports are designed to keep larger hogs away from the young pigs' expensive starter feeds.

This means plenty of jostling around the feeder, but ZINCGRIP Tubing stands up because the manufacturer could select the size and gage that meet exact strength requirements. The tubing takes stresses equally well in all directions.

This manufacturer found that ZINCGRIP Tubing is easy to fabricate. In fact, tests and field experience have proved that it can be formed to the limits of the base metal with no flaking or peeling of the coating. Thus, his customers are assured unbroken corrosion protection on formed parts.

The creep feeder canopy supports made of Armco ZINCGRIP Steel are bolted securely into place on the platform.



Armco ZINCGRIP Tubing is easy to fabricate. Press at left flattens, cuts, and punches two ends of tubing in a single operation. Each drop of the press at right bends the ends of a dozen pieces to ready them for fastening to the creep feeder platform. Neither operation causes any flaking or peeling of the zinc coating.

Other Farm Applications

Armco ZINCGRIP Welded Steel Tubing has many other applications around the farm. These include stock watering tank rims; gate frames; pump cylinders, supply and extension tubes on sprayers; handles on lawn, garden, barnyard, and field equipment; and stalls in dairy barns.

For complete information on Armco ZINCGRIP Tubing, just fill in and mail the coupon.

ARMCO STEEL CORPORATION

1966 CURTIS STREET, MIDDLETOWN, OHIO

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

Armco Steel Corporation
1966 Curtis Street, Middletown, Ohio

Please send me complete information on Armco ZINCGRIP Tubing.

We manufacture_____

Name_____

Company_____

Street_____

City_____ Zone____ State_____

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John Deere Plows

Lead in Modern Design for Fast, Good Work Behind Modern Power

Matched to the power of modern tractors, John Deere Plows fully answer the problem of plowing at faster speeds . . . of getting more work done per day without the slightest sacrifice in seedbed quality . . . of cutting plowing costs.

No other plow design combines shock-absorbing strength with trash-shedding clearance so effectively as John Deere Truss-Frame design. No other plow bottoms can beat John Deere High-Speed Light-Draft Bottoms for fast, good work and fuel economy. No other plow is so precisely adaptable to soil and working conditions as a John Deere with its wide range of easily made "fine line" adjustments.

Backed by 119 years of plow-building "know-how" . . . product of master plow designers working hand in hand with master craftsmen . . . no wonder John Deere Plows lead the field.

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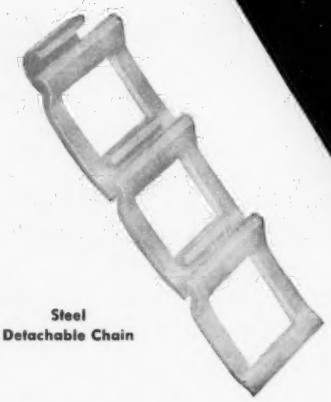
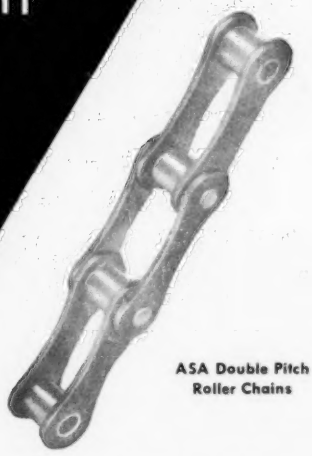
"Wherever Crops Grow, There's a Growing Demand for John Deere Equipment."

fills the gap
in
implement
chains

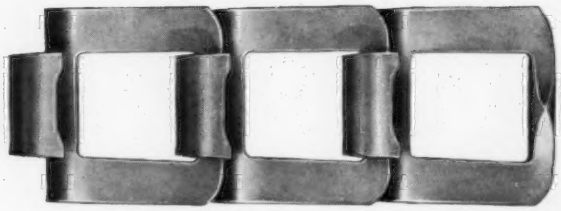


Steel
Detachable Chain



ASA Double Pitch
Roller Chains

A NEW, STRONGER, LONGER LASTING STEEL DETACHABLE CHAIN..."HF" BY CHAIN BELT



For implement applications that require a steel detachable chain that is stronger . . . lasts longer than standard steel detachable . . . New Rex "HF" (High Fatigue Strength) Chain is the ideal answer. At only slightly higher cost, this new chain provides many outstanding advantages:

- **Much higher fatigue strength**
- **Greater tensile strength**
- **Better bearing area assuring less wear and elongation**
- **Easy detachability and coupling. . . eliminates accidental uncoupling in service**
- **Long-life projection-welded attachments**

Investigate the many advantages NEW Rex® "HF" Steel Detachable offers you. Check, too, on the other new developments in implement chains, "AR" and "A" Series Chains, developed by the leader in implement chain design—CHAIN Belt. Your CHAIN Belt District Sales Engineer will be happy to give you the complete details. Write CHAIN Belt Company, 4680 W. Greenfield Ave., Milwaukee 1, Wisconsin.

CHAIN BELT COMPANY

Milwaukee 1, Wisconsin

On materials handling machines used by

Hyster

Baker-Raulang

modern farmers ... by the armed forces ...

Prime Mover

Gerlinger

and by all branches of industry ...

Towmotor

BLOOD BROTHERS UNIVERSAL JOINTS are first choice!

On all kinds of materials handling equipment, dependable Blood Brothers Universals have won "first choice" reputations. This success results in part from close cooperation between our engineers and the men who design the machines . . . with the mutual goal of superior performance for the end user.

When you have a power transmission problem—large or small—contact Blood Brothers' engineers for suggestions. They'll gladly work with you . . . just write or call.

BLOOD BROTHERS MACHINE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
ALLEGAN, MICHIGAN

UNIVERSAL JOINTS AND DRIVE LINE ASSEMBLIES

New CASE self-propelled combine offers

New Model "120" combine features power steering, hydraulic travel speed control and Dayton V-Belt drives for more positive threshing, separation and cleaning.

The new Case Self-Propelled Model "120" Combine is a revelation in comfort, convenience and driver control as well as in its outstanding capacity to thresh and clean grain and seed crops under a wide range of field conditions.

In design, the "120" has all the latest innovations to save grain, save time and labor and reduce harvesting costs.

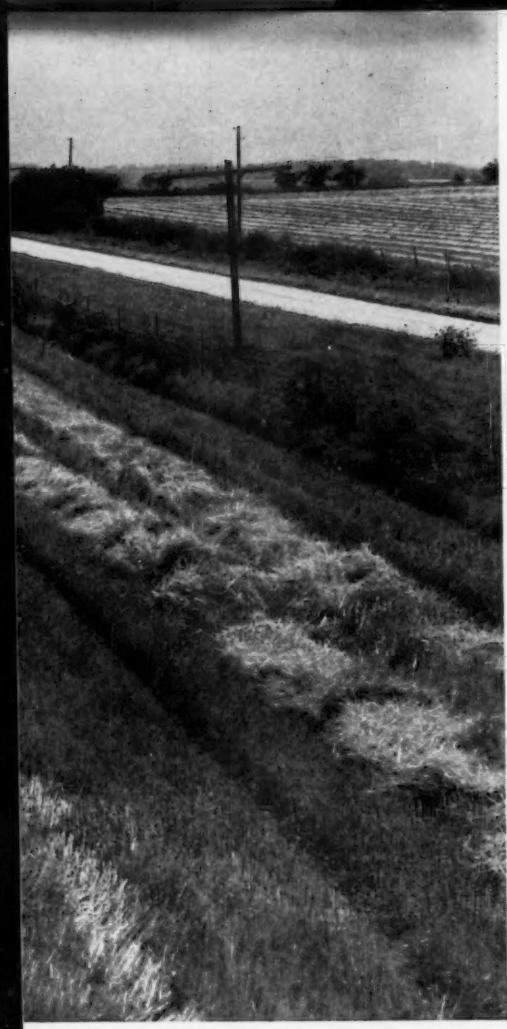
Foremost among the advantages offered is Power Steering, which makes combine operation as simple and pleasant as driving your own car. A big, roomy platform, from which the operator can plainly see header, field, crop and truck or wagon, gives absolute control of harvesting at all times.

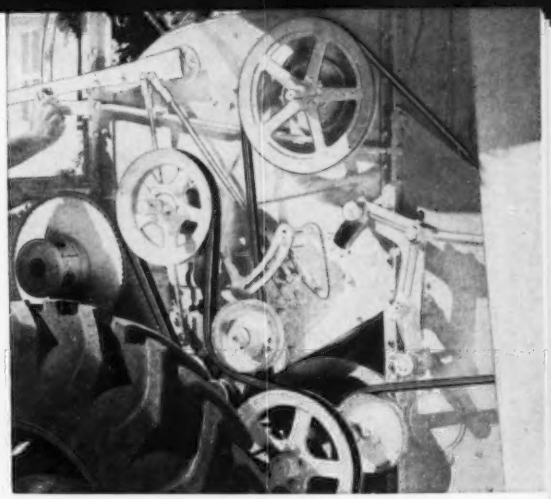
Hydraulic Speed Control, standard equipment on all Case Models "120," provides effortless selection of an infinite number of ground speeds, so speed can be regulated to best suit the particular crop or field condition.

New grain-saving header and feeder provide uniform delivery of grain to the feeder spout and across the full width of the cylinder. Dayton B.S.I.* V-Belts, approved for the cylinder drive — one of the most critical on the combine — provide continuous, uninterrupted rotary power. Specially designed for back side idler operations, Dayton B.S.I. V-Belts dependably transmit all the power from the power source, efficiently, economically.

Possibly a Dayton B.S.I. or one of the complete line of Dayton Agricultural V-Belts is the answer to your power transmission problem. It's worth your while to find out by writing The Dayton Rubber Co., Agricultural O.E.M. Div., 400 W. Madison St., Chicago 6, Ill.

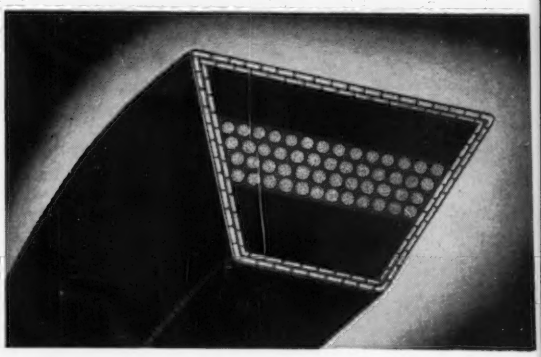
*Back Side Idler



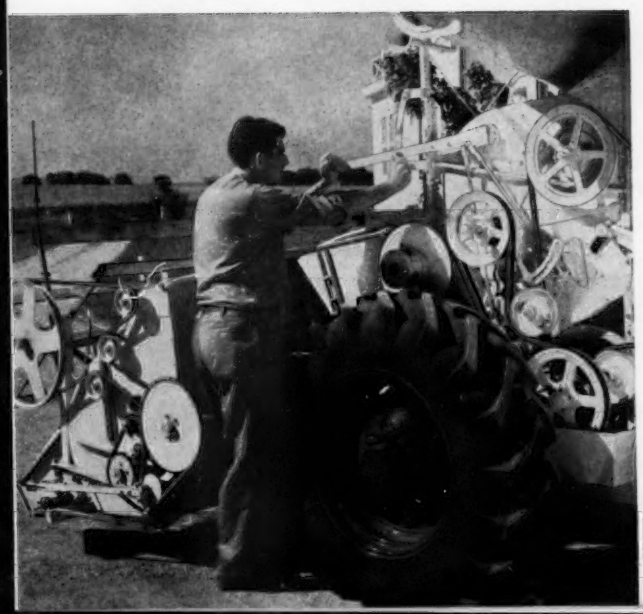


The Case "120" saves hours of time when grain is ready. Equipped with a concave clearance indicator, adjustments for various crops can be made quickly and easily for maximum harvesting efficiency. A variety of special cylinder speeds are available for harvesting beans, grasses, vegetable and flower seeds, flax and other crops.

Specifically built to withstand the stresses of flexing in opposite directions, the Dayton B.S.I. V-Belt is wrap-molded, manufactured of highest quality rubber, cord and fabric.



better control, more profitable harvest.



Specially designed to pull on through "slug" loads, Dayton B.S.I.'s have proved their worth on farm equipment for many manufacturers, providing dependable, economical power under all field conditions.

© D. R. 1956

Dayton Rubber 51 YEARS OF PROGRESS

First in Agricultural V-Belts

Agricultural Sales Engineers in Atlanta, Chicago, Cleveland, Dayton, Moline, New York, San Francisco and St. Louis

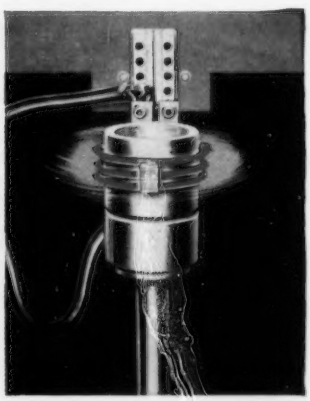
HERE'S WHAT SEALMASTER IS DOING FOR THE FARMER

Top performance with longer service and less maintenance . . . that's the SEALMASTER record on quality farm machinery all over the world. Today's farmer looks to SEALMASTER for his guarantee of quality when he buys equipment. He knows that SEALMASTER'S exclusive combination of features meet the demands of his most rugged operation. There's the patented labyrinth seal, self alignment, floating retainer and many others . . . INCLUDING . . .

ZONE HARDENING

for Positive Race to Shaft Locking

This patented SEALMASTER feature is of particular importance to the farm field where positive locking of bearing race to shaft is vital to smooth, continuous machinery performance. The inner race ring is induction heat treated through ball path only, leaving the extended portions in their original metallurgically soft, tough state. Hardened set screws are tightened through the soft extension to provide firm race to shaft locking. Shaft wear is eliminated and fretting corrosion is reduced, assuring top bearing performance.



SEALMASTER BALL BEARING UNITS

Bulletin 454 should be in your files. Write for it today!

SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO., 67 RIDGEWAY AVENUE, AURORA, ILLINOIS

RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

The important facts about nuts

A nut's purpose is to load the bolt in tension for a tight joint. For this, it is given shear strength greater than the breaking point of the bolt; and sufficient bearing area to avoid crushing or flow of the bearing surface with consequent reduction of tension.

While the thread form of a nut is accurate, its "lead" cannot, for practical purposes, be made identical with that of the bolt. Thus, a nut is made from material plastic enough to allow the threads to deform upon tightening and thereby adjust to distribute the load over many threads rather than concentrate it on the first few.

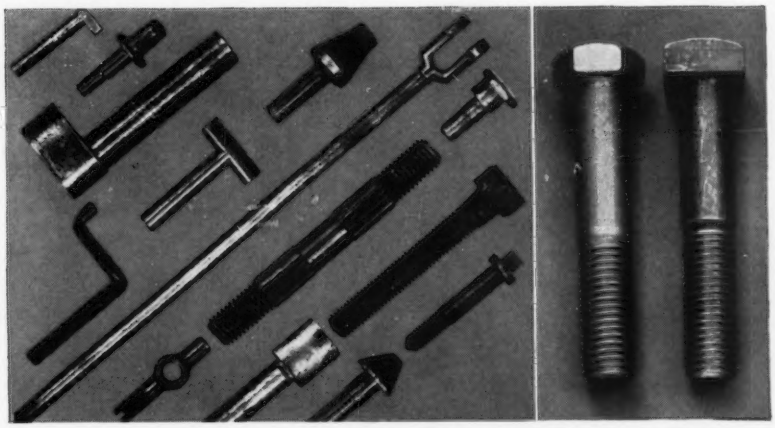
WHAT TO USE

The standard "Finished" nut series satisfies the requirements. It gives not only the required bearing area, but also enough section for proper strength and to minimize the spreading or dilation of a nut when loaded. (The standard "Heavy" nut series is called for only when bolt holes have large clearances, or for high bolt loads.)

As a good general guide to follow, use nuts that are:

1. Made to Am. Std. dimensions;
2. Made from soft, ductile material;
3. Strong enough to break the bolt or screw with which it is used. This would determine whether "Finished" or "Heavy" series is selected.

Cold heading produces strong, low cost parts



Representative range of mechanical parts produced by RB&W by cold heading . . . the same process used to produce the high quality, economical RB&W standard bolts and cap screws shown at right.

Here's a product-improving fact often overlooked: The same forming operation that produces large volumes of strong fasteners at surprisingly low cost can also be used for headed, special mechanical parts.

Cold heading upsets metal along its own axis. Flow lines are continuous, without folds, giving greater head strength against shear, fatigue and impact. Moreover, the material has better quality to start with, since unsound metal would distort or open in the operation and be rejected automatically. Uniformity is assured. Finish is also better.

Designers and production men get all these physical advantages when using RB&W standard bolts and cap screws. They can also have them in special parts at low cost when the need is of sufficient volume to justify machine set-up time. For more information and help on your specific needs, write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

Plants at: Port Chester, N.Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

30% faster assembly — and joints stay tight

When famous-make chain saws were fastened with regular screws plus washers, they loosened on the job. Then SPIN-LOCK screws were used. These not only held tight, they also speeded assembly time 30%. What's more, they cost no more than former screw plus lock washer.

SPIN-LOCK screws have self-anchors in the form of hardened, tiny teeth which dig in and hold under severe service. Various types, sizes and heads available. Send for data or see Sweet's Product Design File.

HOME MADE

ROTARY HOE

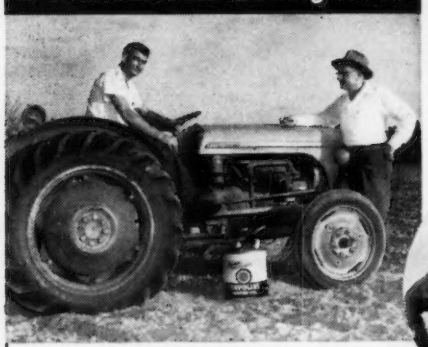
Reduces Hand Hoeing 75%

HAND hoeing of cotton, peanuts or most any row crop is a tedious and expensive job. A. D. Hatton, overseer of the 642-acre Spann and West Farm, near Dothan, Alabama, studied the problem, designed and built the rotary hoe shown here. He found it eliminates seventy-five per cent of the hand hoeing. The rotary hoe is placed between the cultivator shovels. It pulverizes the soil and keeps small vegetation down. It does not injure the plants.

Mr. Hatton, like keen farmers and ranchers the country over, has found that *it pays to farm with Texaco products.*

A. D. Hatton *(center)* shows Texaco Consignee I. H. Hanahan *(left)* rotary hoe he developed on farm, near Dothan, Alabama. Mr. Hatton, farm overseer, finds Marfak lubricant sticks to bearings better and longer, sealing out grit and dirt. It won't wash off, drip out, dry out or cake up.

Meet FFA's Star Georgia Planter of 1955... James Whittington, 19

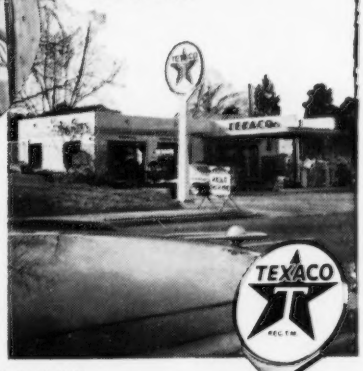


James Whittington *(left)*, 19-year-old farmer of Omega, Georgia, won the state's highest FFA award as "Star Planter" in 1955. He and his mother operate the 75-acre farm. He made his first crop at 14. A straight "A" student in high school, he won a college scholarship; drives fifteen miles to college and runs the farm between classes. Texaco Consignee R. H. Pittman *(right)* is proud to serve the Whittingtons. Young Whittington uses the best motor oil money can buy—Havoline.

Texaco products have been used on the 2,600-acre Goldman Plantation, at Goldman, Louisiana, for twenty-seven years. The neighborly service during that time has been given by Texaco Consignee Ben Chase *(left)* shown with H. T. Goldman, Jr. Ben has just delivered a tankful of Fire Chief, the gasoline with superior *"Fire-Power"* for low-cost operation

Wherever you go—in all 48 states—

Texaco Dealers will help you . . . with top octane Sky Chief gasoline, super-charged with Petrox, to give maximum power and reduce engine wear . . . famous Fire Chief at the *regular* price, both 100 per cent *Climate-Controlled* . . . Advanced Custom-Made Havoline and Marfak lubrication. It pays to tour with Texaco.



THE TEXAS COMPANY

ON FARM AND HIGHWAY IT PAYS TO USE TEXACO PRODUCTS

DIVISION OFFICES: Atlanta, Ga.; Boston 16, Mass.; Buffalo 9, N. Y.; Butte, Mont.; Chicago 4, Ill.; Dallas 2, Tex.; Denver 3, Colo.; Houston 2, Tex., Indianapolis 1, Ind.; Los Angeles 15, Calif.; Minneapolis 3, Minn.; New Orleans 16, La.; New York 17, N. Y.; Norfolk 10, Va.; Seattle 1, Wash.

Texaco Petroleum Products are Manufactured and Distributed in Canada by McColl-Frontenac Oil Company Limited.

WHERE POWER STEERING REALLY COUNTS

—making the job easier for the man who rides a tractor

Power steering is every bit as desirable for farm tractors as it is for passenger cars—*and for more and better reasons.*

By taking the tiresome muscle work out of steering, it makes tractor work not only an easier task but a far more efficient operation.

For example, power steering eliminates wheel fight and shock even over the roughest ground; it holds the wheel firmly against the furrow when plowing; it permits the tractor to be controlled by simply "pointing" where the driver wants it to go.

Also, short turns become an easy, one-hand job even when the tractor is standing still.

Any way you look at it, power steering saves time as well as work, and that's exactly why power steering on farm tractors is destined to be the next step forward in farming efficiency.

Bendix Power Steering is a performance-proven product designed and engineered by Bendix, foremost producer of power steering and brakes for the automotive industry.

It is used with a conventional steering gear and is adaptable to existing steering linkage, permitting tractor manufacturers to make production-line installations without costly or extensive engineering changes.

Manufacturers interested in adding Bendix Power Steering to their present list of sales features are invited to write for further details to BENDIX PRODUCTS DIVISION, SOUTH BEND, INDIANA.

Export Sales and Service:
Bendix International Division,
205 East 42nd Street, New York 17, N. Y.

*U.S. Pat. Off.

Bendix PRODUCTS DIVISION South Bend IND.

Bendix AVIATION CORPORATION

NEW

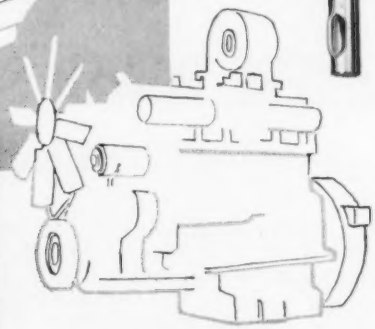
Tachometer Take-Off

...for VEEDER-ROOT Rev-Counters

With this new attachment, Veeder-Root Rev-Counters can be installed on any engine having a tachometer take-off in a position which is readily accessible for easy reading. Take-off can be furnished to suit average engine-speed.

So now you can make it easier than ever for your customers to see that your product is performing up to its guarantee . . . to see when routine maintenance is coming due, and whether servicing is needed.

You can count on Veeder-Root to figure out how to engineer these adaptable Rev-Counters into *your* products . . . not only engines, but generators, compressors, heaters, refrigerators, and what have you? Write:



Everyone... Can Count on

VEEDER-ROOT
INCORPORATED
HARTFORD 2
CONNECTICUT

New York 19, N. Y.
Greenville, S. C. • Chicago 6, Ill.
Montreal 2, Canada
Offices and Agents in Principal Cities

Morse Roller Chain provides vital drives in 12-ton-per-hour New Holland Hay Baler

Detail of New Holland Super 77 Hay Baler, showing Morse Double-Pitch Roller Chain on knotter drive. This is one of four vital baler drives utilizing Morse Chain.

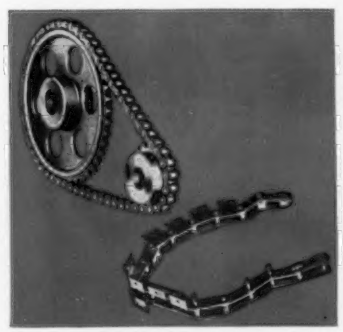
"One of the four places in our new Super 77 Hay Baler where we use Morse Chain is in the vital drive of the knotter assembly," reports New Holland Machine Company (New Holland, Penn.), leading agricultural equipment manufacturers. "This one important chain controls the plunger action while the bale is being tied.

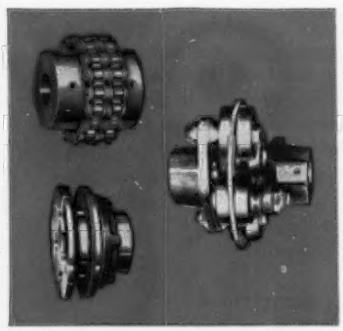
"From long experience in manufacturing grassland equipment, New Holland knows how important the action of this one chain is in the knotter assembly. The chain's reliability can make or break a farmer's baling record for the day or for the season."

Leading farm machine makers across the country depend on Morse for power transmission equipment. Morse makes a complete line of roller chain, couplings, sprockets, torque limiters, and special-purpose roller chain attachments for conveyors, etc.

Free help and information

Write, wire, or call today for information on any phase of your product development which involves power transmission. Or call in our local expert, your nearby Morse Distributor.





MORSE PRODUCTS FOR AGRICULTURAL EQUIPMENT

Morse Roller Chain Drive. Special double-pitch chain mockup, showing variety of special attachments.

Morse Roller Chain Couplings, Morflex Flexible Couplings, adjustable Morse Torque Limiter.

MORSE CHAIN COMPANY
INDUSTRIAL SALES DIVISION
ITHACA, N.Y.

MORSE MORSE B-W BORG-WARNER *

POWER TRANSMISSION PRODUCTS

*trademark

3-way forage harvester!

Versatile new self-propelled unit is driven by TDA® transmission-and-axle!

The self-propelled forage harvester you see here is something new in the farm implement field. Equipped with 3 basic attachments, this single piece of equipment will harvest all types of forage crops from corn to grasses or legumes, whether row or broadcast, standing or windrowed.

When the time came to design a special combination transmission and axle for this new harvester, the manufacturer called on Timken-Detroit®—the world's leader in the axle field.

TDA's engineers agreed with the manufacturer that the design of this special driving assembly presented some special problems. But as it turned out, they found they had solved practically the same problems for another manufacturer in a related field. So, by modifying an existing design, they were able to meet the specifications of the new forage harvester exactly—and at substantial savings, both in time and in development and manufacturing costs.

This is a typical example of TDA's experience in producing drive assemblies for the farm implement field. If you have a problem in designing or building farm equipment, remember, you can always depend on TDA's long experience and vast manufacturing facilities to get the job done right and at low cost. Your inquiries are welcomed.

TIMKEN Detroit AXLES
TIMKEN-DETROIT AXLE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
DETROIT 32, MICHIGAN
The Accepted TDA Standard
TRADE MARK REGISTERED

Plants at: Detroit, Michigan • Oshkosh, Wisconsin
Utica, New York • Ashtabula, Kenton and Newark, Ohio
New Castle, Pa.

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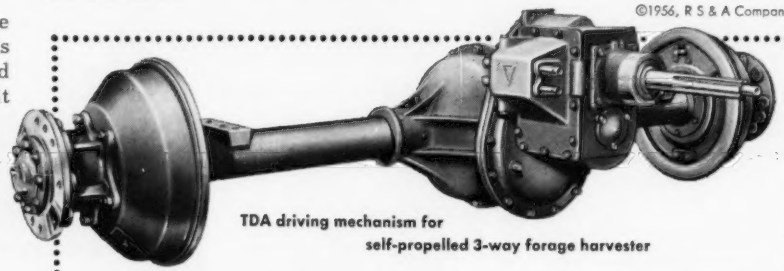


TDA driving mechanism for self-propelled 3-way forage harvester

CAT* D2 TRACTOR

...for "do-it-yourself" conservation farmers!

TODAY . . . the man with a Cat Diesel Farm Tractor is truly boss of his farm! He has the diesel economy, crawler traction, and big working capacity needed for greater farming efficiency. He also has the basic means of putting his conservation program into practice.

The Cat D2 Tractor has helped many farmers to make better use of their time and manpower. Caterpillar builds five larger sizes, 50 to 230 drawbar HP. Ask your Caterpillar Dealer for a farm power analysis and details on the equipment that fits the job.

CATERPILLAR TRACTOR CO., Peoria, Illinois, U.S.A.

38 drawbar HP

RECLAIM, IMPROVE LAND . . . D2 with Tool Bar Bulldozer fits needs of many conservation farmers, since it handles such jobs as building dams, digging ditches and trench silos, forming land.

PULL BIG IMPLEMENTS . . . D2 conserves manpower, time and fuel by pulling wide, deep hitches or handling several tools at once. Ideal for breaking new land, stubble-mulching, working rough ground.

DO PRECISION WORK . . . Tool Bar tillage offers great ease and accuracy of control. Cat "Swing-Around" Tool Bar is quickly adjustable from bulldozer to rear-mounted tools.

FREE BOOKLET:
FARM TRACTORS AND BIG HITCHES . . . *see how farmers have cut their operating costs by using big equipment pulled by Cat Diesel Tractors. See your Dealer or write Caterpillar Tractor Co., Dept. AE76, Peoria, Ill.*

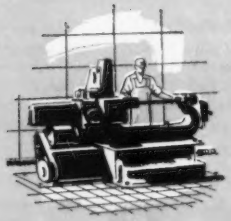
CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

POWER TO PUT CONSERVATION INTO PRACTICE

A complete line of Roller Bearings . . .

For every field of transportation and industry

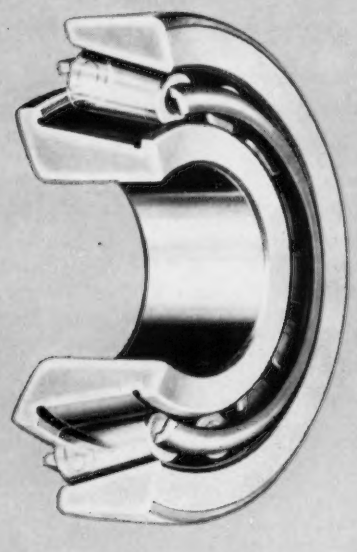


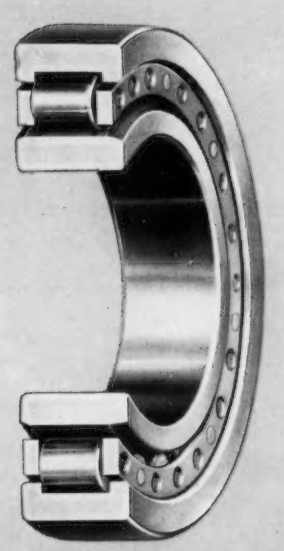
Job-tailored in a wide range of sizes to fit your specific needs.

Aircraft? Automobiles? Earth-moving or farm equipment? *Whatever* you make, if your product uses straight or tapered roller bearings, Bower can meet your specifications *exactly*. For dependable Bower bearings are virtually custom-built to the job . . . engineered and sized to match any requirement.

Important, too, are exclusive Bower design features that assure long life, top performance, *less maintenance*. And when you specify Bower bearings you can always be certain of the highest quality materials and workmanship. These reasons, of course, are why Bower straight, tapered and journal roller bearings are used by leading manufacturers everywhere—for any application.

Let a Bower engineer give you full details of the complete Bower line. Call him in while your product is still in the design stage.





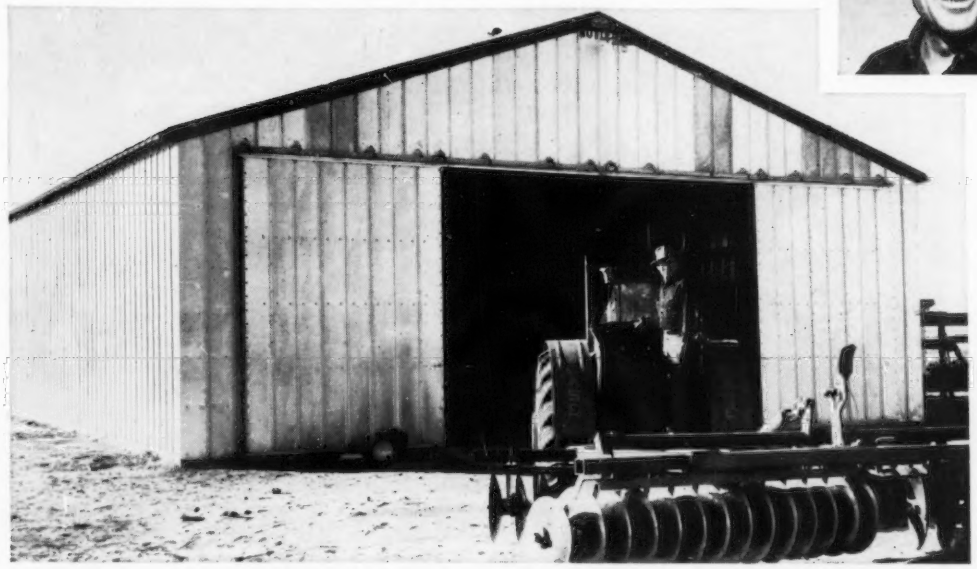
SPHER-O-HONED

BOWER ROLLER BEARINGS

BOWER ROLLER BEARING DIVISION • *FEDERAL-MOGUL-BOWER BEARINGS, INC., DETROIT 14, MICH.*

"I make my money farming, not fixing things up"

says F. M. Greathouse, Garden City, Kansas



This tandem Disc Harrow can be pulled right through those big doors without any dismantling—a great time and labor saver.

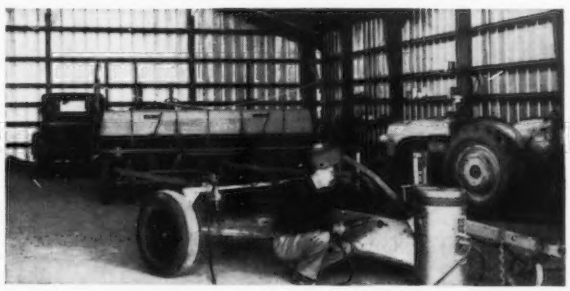
"Steel buildings don't need maintenance—
no painting, no patching,
nothing to worry about."

Mr. Greathouse chose his 36′ x 60′ Steel Building for two practical reasons—economy and convenience. It's economical in that the initial cost is moderate, and, most important, it requires virtually no upkeep. Secondly, he has so much storage space for grain that he doesn't have grain elevator fees to pay at harvest time.

The convenience and versatility of Mr. Greathouse's Steel Building have shown up in many ways. In addition to grain storage, he uses it for machinery storage and as a repair shop. Furthermore, since he buys calves to raise each year, he has found he can modify his Steel Building easily and inexpensively to house the calves at one end.

Mr. Greathouse expects his Steel Building to last through his lifetime. "It is ideal for my purposes," he says, "and I'd recommend a Steel Building to any farmer, anywhere."

Factory-Built Steel Buildings, fabricated from USS Galvanized Steel Sheets with USS Structural Steel framework, can do a great deal toward making *your* farm a more practical, better paying investment. For the complete rundown on all the advantages of Factory-Built Steel Buildings, return the attached coupon. No obligation, of course.



Using the Steel Building as a repair area, Mr. Greathouse does some welding on a ditching machine.

WANT TO MODERNIZE YOUR FARM FOR A BETTER INCOME? SEND THIS COUPON TODAY

Agricultural Extension
United States Steel Corporation
Room 5408, 525 William Penn Place
Pittsburgh 30, Pa.

I am interested in steel buildings for the following:

☐ *dairy barns* ☐ *hay storage* ☐ *machinery storage*
☐ *cattle shelters* ☐ *grain storage* ☐ *poultry houses*

☐ *other* . . . . . .

Approximate size or capacity . . . . . .

☐ *Please have a Steel Building representative call on me with further information.*

Send information to:

Name . . . . . .

Address . . . . . **Town** . . . . . .

County . . . . . **State** . . . . . .

United States Steel produces high-quality USS Galvanized Steel Sheets and Structural Steel which our customers manufacture into durable farm buildings. Your request for information will be forwarded to the manufacturers of these buildings, and you will hear directly from them.

UNITED STATES STEEL

Case "400" Tractor and Model 250 Anhydrous Ammonia Applicator—J. I. Case, Racine, Wisc.

Three Important Roles for Rochester Gauges

For more than 20 years Rochester Manufacturing Company has supplied Criterion tank gauges to the LP-Gas industry, and engine gauges to the tractor industry. It was only natural that they should step forward to meet the need for tank gauges for Anhydrous Ammonia fertilizer and for LP-Gas powered tractors.

1. ANHYDROUS AMMONIA TANK GAUGES—built to register liquid levels in storage, mobile and applicator tanks. Rugged cast head holds 1200-pound test pressure. Easy-to-read, weather proof removable dial. Float and gear assembly built to take heaviest vibration and shock punishment.

2. LP-GAS TRACTOR FUEL TANK GAUGES—same rugged design and construction features make the RMC Criterion, the most dependable gauge available for LP Gas tractor tanks.

3. TRACTOR ENGINE OPERATING GAUGES—Whether gasoline, diesel or LP-Gas powered, 9 out of 10 major tractor manufacturers use RMC temperature, oil pressure and ampere gauges. Rochester tractor engine gauges have become recognized as the industry standard.

Look to RMC for Full-Line Instrumentation

PRESSURE GAUGES

Illustrated here is a heavy-duty water pump gauge. Sealed from dust, and moisture proof. What are your pressure gauge problems?

FUEL GAUGES

Illustrated here is a tank-mounted fuel gauge with magnetically driven pointer. Head pressure tight to tank contents. Sealed against dust and moisture. What are your fuel gauge requirements?

Manufacturers: TELL US YOUR REQUIREMENTS FOR DIRECT MOUNTING AND REMOTE INDICATING INSTRUMENTS, AND LET RMC ENGINEERING SKILL PROVIDE THE ANSWERS!

Sold Only As Manufacturer's Original Equipment.

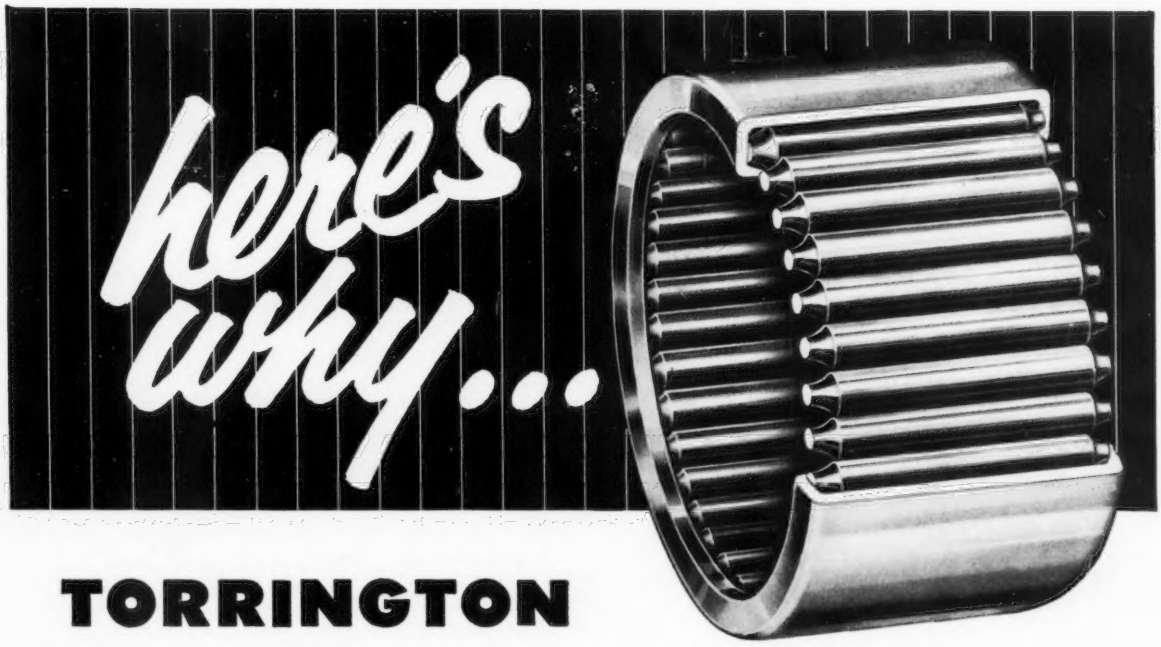
RMC

"You Can Rely On Rochester"

LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

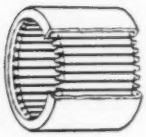
ROCHESTER MANUFACTURING CO., INC.

99 ROCKWOOD STREET • ROCHESTER 10, N.Y.

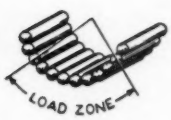


TORRINGTON

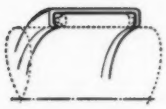
DC needle bearings give high-capacity performance in minimum space



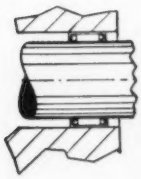
Unique construction—accurately drawn, surface-hardened shell retains rollers and serves as outer raceway.



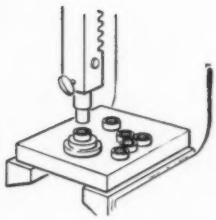
Full complement of small diameter rollers—precision-ground and through-hardened—assures top capacity by distributing load over large number of contacts.



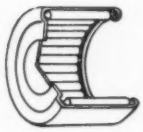
Turned-in lips of the case-hardened outer shell keep dirt and grit out, lubricants in—while retaining trunnion ends of rollers. All wear surfaces of outer race are case-hardened.



No inner race required on surface-hardened shafts—reduces space requirements, lowers unit costs.



Simple assembly—arbor press seats bearing in round housing bore. No collars, shoulders or retaining rings needed.



Closed end type DC Needle Bearings are available for stub shaft applications. The closed end provides a perfect seal at no extra cost.

Needle Bearings are made in a Precision Series for most applications and an Extra Precision Series where low radial play and minimum eccentricity are required. Easy lubrication through optional hole in shell or through hole in shaft assures long service life. Bearings can be pre-packed with suitable grease for those applications requiring grease lubrication.

See our new Needle Bearing Catalog in the 1955 Sweet's Product Design File—or write direct for Catalog No. 55.

THE TORRINGTON COMPANY

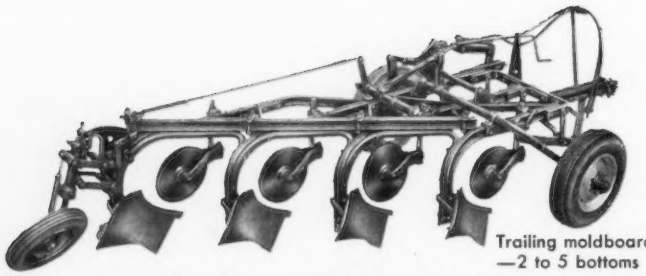
Torrington, Conn. South Bend 21, Ind.

District Offices and Distributors in Principal Cities of United States and Canada

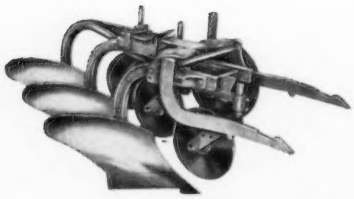
TORRINGTON BEARINGS

90th ANNIVERSARY 1866–1956

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers



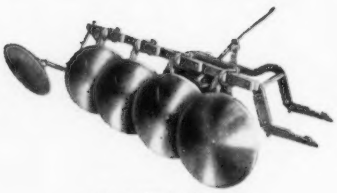
Trailing moldboard plows —2 to 5 bottoms



Fast-Hitch moldboard plows —1 to 3 bottoms

48 models..98 sizes mean an exactly right

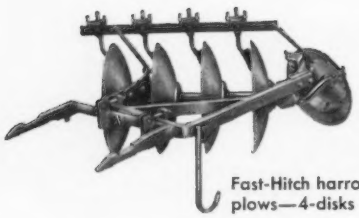
Two-way Fast-Hitch moldboard plows—1 and 2 furrows



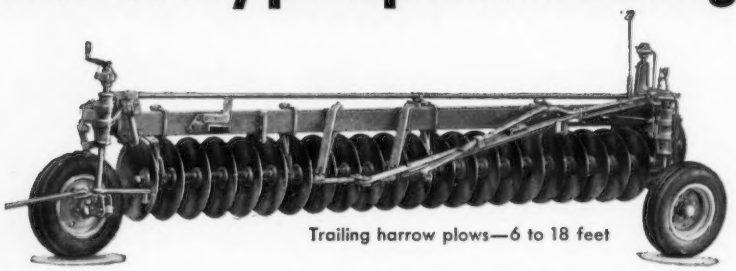
Fast-Hitch disk plows —2 to 4 furrows

Two-way Fast-Hitch disk plows—3 furrows

McCormick® plow for every prospect..creating



Fast-Hitch harrow plows—4-disks



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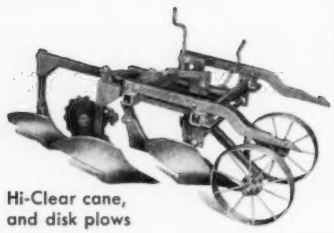
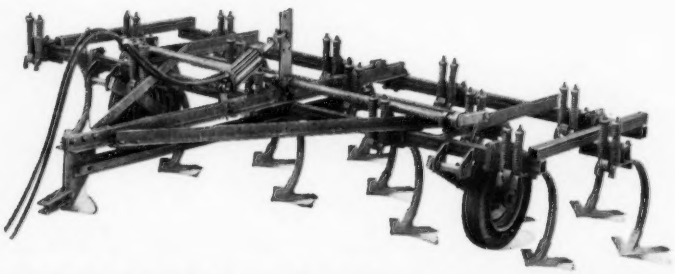


Hi-Clear cane, and disk plows



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AGRICULTURAL ENGINEERING

VOL. 37 AUGUST, 1956 No. 8

Multiple-Discharge Fertilizer Pump

Charles W. Gantt, Jr.
Member ASAE

How uniform application of liquid fertilizer to field crops was made possible as the result of the development of a practical, inexpensive metering hose pump

DEVELOPMENT of an inexpensive device for field application of liquid fertilizer with a metering pump formed the basis for a cooperative research project conducted jointly by agricultural engineers of North Carolina State College and the U.S. Department of Agriculture and reported in this paper. It was desired to develop a simple unit that would maintain a constant application rate at varying tractor ground speeds, and one that would be practical for the small-acreage farmer. As a result of preliminary tests on eight commercial pumps and on a non-commercial hose pump invented by H. A. Arnold, agricultural engineer at the Tennessee Agricultural Experiment Station, and patented by him in 1946, the hose-type pump showed the most promise, and it was decided to develop and improve this pump.

The hose pump consists of a number of flexible hose stretched over a four-roller reel. The rollers are spaced in the reel about 2½ in apart. The hose are anchored in an inverted U form so that at least two rollers are always in contact with the hose. The hose are attached to an intake manifold on one end and to a hose fitting that is attached rigidly to the pump frame on the other end. From this output fitting, the liquid discharges through connecting hose to the applicator depositor. The reel is rotated by a suitable chain drive from a ground wheel (Fig. 1).

As the reel is rotated, the rollers move or roll along the hose. Where the rollers are in contact with the hose, the latter are closed tightly. This closing creates a valve in the interior of the hose. When not in contact with the rollers, the flexible hose tends to regain its original shape, and thereby carry liquid as a regular hose. As the reel turns, the contact of the rollers with the hose creates a pumping action that first pulls and then pushes the solution through the flexible hose.

Paper presented at meeting of the North Atlantic Section of the American Society of Agricultural Engineers at Storrs, Connecticut, August, 1955.

The author—C. W. GANTT, JR. is associate agricultural engineer, fertilizer distributing machinery project (ARS) U. S. Department of Agriculture.

Acknowledgment: The author acknowledges the cooperative work on the project by Henry D. Bowen, agricultural engineering department, North Carolina State College, and the assistance in construction developments at the USDA agricultural engineering laboratory, Beltsville, Md., by D. B. Eldredge. The pump is now being manufactured commercially.

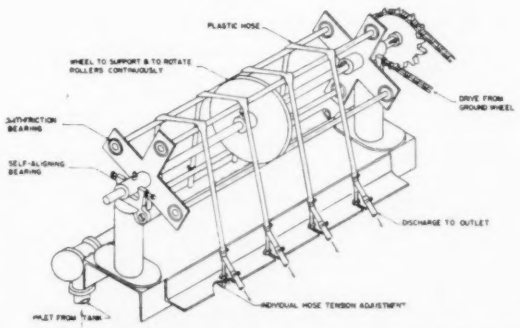


Fig. 1 Hose pump for metering liquid fertilizer in field application. Liquid is trapped inside the flexible hose in the spaces between the rollers. As the four rollers travel in a circle, the trapped liquid is carried around until released and discharged. The individual hose-tension adjustment permits adjusting each hose to equalize the amount of liquid metered from each hose. The tension must be tight enough to make a closure of the hose at point of contact with rollers

The original models of the hose pump (Fig. 2) were designed to be built by the farmer. The rollers were made of ½-in pipe that was slipped over a ⅜-in cold-rolled shaft with a babbitt bearing about 1¼ in long at each end of the pipe. Rubber hose ⅜-in inside diameter and ⅝-in outside diameter were used and all were tightened simultaneously.

Although short hose life and irregular discharge rates had been reported as objections to the pump as a metering device for field operation, it possessed the following favorable features, and it was decided to concentrate the project work on the elimination and correction of the objections:

- Each outlet is supplied by an individual pump. Since each hose on the pump operates as a separate metering unit, then one pump with 12 hose is in fact 12 metering pumps. Therefore, no restrictions are needed in the lines to equalize the distribution between a number of outlets.
- No cutoff valve is required inasmuch as the flow stops when the reel stops turning.
- There is no corrosion problem since the solutions do not come in contact with the moving parts.
- The hose pump can be driven directly from a ground wheel because the usual fertilizer application rates are obtained at low pump speeds. As an example, to apply 50 lb of nitrogen per acre using a 37 percent nitrogen solution requires about 17 gal of solution per hour per row when traveling 3 mph on 40-in rows. The approximate hose pump reel speed is 120 rpm to give 17 gal per hr through each hose. Some of the conventional pumps must operate at speeds of about 500 to 1000 rpm to produce flow rates of liquid fertilizer that are commonly applied.
- Liquid fertilizer is applied at a constant rate per acre regardless of ground speed of the applicator. Fig. 3 shows the straight-line relationship between speed and output or discharge of the hose pump. By having the pump ground driven, any change in the ground speed will produce a directly proportional change in output and thereby maintain a constant rate of application.
- The hose pump requires no by-pass line. As long as the outlet tubes are unrestricted, the hose pump is a positive displacement pump. However, if an outlet becomes plugged, the hose over the rollers will stretch enough, to allow the rollers to pass and the liquid will remain stationary without damaging the pump. Furthermore, the additional pressure

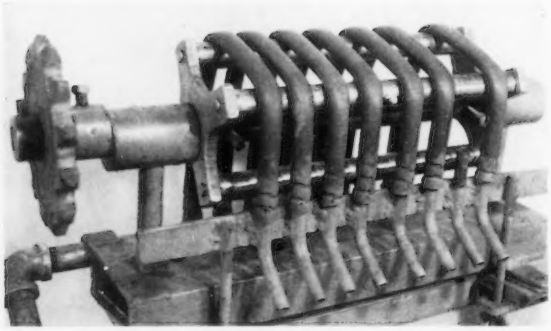


Fig. 2 Hose pump built at the University of Tennessee and patented in 1946. This model from parts commonly available was designed to be built with a minimum of skilled labor and cost

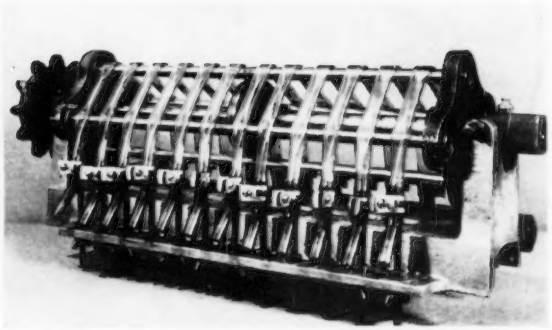


Fig. 4 This view shows the discharge or output side of a commercial hose pump. This model is equipped with stainless steel rollers, nipples and tension adjustment screws

developed by the extra stretching of the hose would tend to force the plugging material through the outlet.

- The cost of replacing pump hose is low. The estimated life of a set of hose is about two to three years for the average farmer.
- Frequency of pulsations is high enough so that there is no problem of smoothing out the flow. The hose pump has actually four "strokes" per revolution as compared with one stroke per revolution of some other types.
- The adjustments to be made for fertilizer rates can be determined by formula calculations after a few measurements are made.
- The pump is not damaged if operated "dry" after the solution runs out. However, the hose may lose some of their resilience if operated dry at high speeds for an extended period.

Modifications in Hose Pump

During the course of development work on the hose pump, six major changes were made on the original pump, in an attempt to increase the hose life and to make the pump more accurate for metering low-pressure fertilizer solutions.

First, a change from rubber to a plastic hose material was made. This change increased the life expectancy of the hose about five times, and in laboratory tests the plastic hose ran 450 hr at 150 rpm before failing.

Second, ½-in rods were used for rollers, and third, the rod rollers were supported on ball bearings instead of babbitt bushings. These changes reduced friction on the hose and helped to further increase life of the hose.

Fourth, a wheel was installed in the center of the reel to help support the rollers. This wheel keeps the rollers turning on the bottom half of the reel cycle. If the rollers are allowed to slow down or stop turning on the bottom, the tubes will become worn at a point where these rollers are started to turn at full speed again.

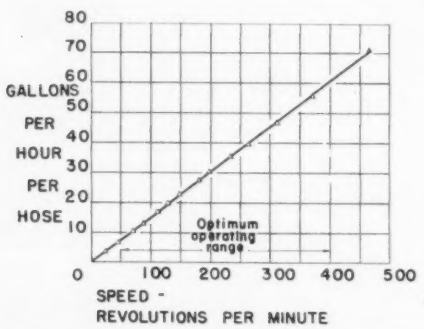


Fig. 3 Speed-output characteristics of hose pump with constant head of 15 in of water and discharge tubes unrestricted

Fifth, individual tightening screws for adjusting tension on the hose were installed.

Sixth, the intake manifold was increased in size to conform with the maximum intake requirements to avert any excessive friction head in the manifold.

A 12-hose model pump weighs about 33 lb; Fig. 4 shows a commercial model of the pump.

With the preceding alterations, it is possible for the accuracy of metering the solutions through the hose pump to be held to a variation of less than 10 percent. With individual hose-tightening screws, each hose can be adjusted until outputs from all hose are equal. To make the adjustments, the pump may be operated with the outlet hose feeding into equal size containers, or held in a vertical position to form their own containers. Hose that fill the containers fastest should be tightened because as the hose are pulled tighter their output is reduced. This adjustment procedure is continued until the hose fill all the containers evenly.

The plastic hose which was found to give best service and operating characteristics is a vinyl chloride acetate material and is thermoplastic in nature. The hose size is ⅜ in inside diameter by ½ in outside diameter and 1/16 in wall thickness. Table 1 gives some specifications on the plastic hose that is now used on the pump.

TABLE 1. SPECIFICATIONS* OF PLASTIC HOSE USED FOR HOSE PUMP

Color	Clear
Tensile srength, psi	1450-1500
Low temperature range	Flexible at minus 20F becomes brittle at minus 50F
Max. Recommended Operating Temperature	165F
Elongation percent	400
Odor	Slight
Taste	None
Flameproofness	Burns
Aging characteristics	Excellent, non-oxidizing
Chemical resistance	
Strong acids	Good
Weak acids	Excellent
Strong alkalies	Excellent
Weak alkalies	Excellent
Maximum suggested working pressure for above size hose	33 psi

*Specifications obtained from and used by permission of the United States Stoneware Co., Akron, Ohio

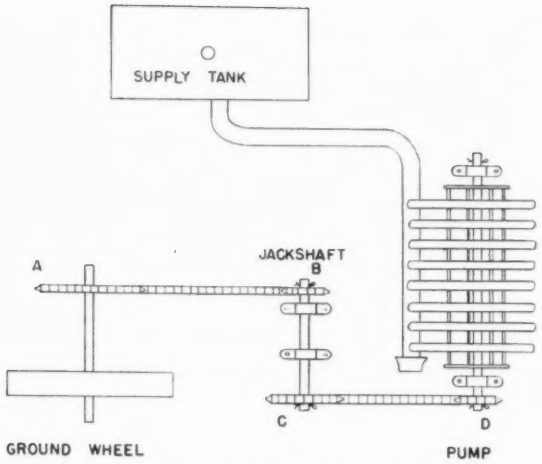


Fig. 5 Schematic diagram showing ground-wheel-drive arrangement. Letters *A, B, C,* and *D* refer to the number of teeth on sprockets for determining drive sprocket ratio and regulation of fertilizer rates

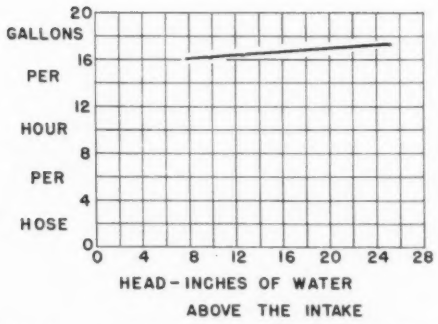


Fig. 6 Head-output characteristics of hose pump with constant speed of 110 rpm and normal hose tension

Regulating Fertilizer Rates

The number of gallons of fertilizer per acre to be applied with the hose pump can be regulated by varying the ratio of revolutions between the ground wheel and the pump reel. This can be done by using various sizes of chain sprockets. To calculate the sprocket sizes needed for given fertilizer rates per acre, the following formula may be used:

Pump reel revolutions per acre ÷ drive wheel revolutions per acre = Drive sprocket ratio

or Gallons per acre × reel turns per gallon × row width (feet) × drive-wheel circumference (feet) ÷ 43,560 = AC/BD.

The letters *A, B, C, D* refer to the number of teeth on sprockets in positions as shown in Fig. 5. The number for reel-turns-per-gallon is the number of times the reel turns to discharge one gallon of fertilizer solution through one hose. When one hose treats two rows, the row width should be doubled in the above formula, and if two hose are to treat one row, then the row width should be divided by two. When using an applicator boom, such as for top-dressing grain crops, the measured distance in feet between hose should be used for row width. The drive-wheel circumference can be determined by measuring the center of the axle to the ground surface and multiplying by 6.28, but an allowance of 5 to 10 percent should be made for wheel slippage. (Subtract the allowance for a power wheel and add for a trailer wheel.) The drive-wheel circumference can be determined more accurately by measuring the distance the machine travels during 10 revolutions of the drive wheel, and then dividing the measured distance in feet by 10.

Chart of Sprocket Ratios

A chart that lists the sprocket ratios in numerical order must be used with the above formula to make it practical. The sprocket on the ground wheel is usually fixed, so that a numerical listing of the sprocket combinations of C/BD will allow the size of these sprockets to be determined quickly and positively. The chart is derived by calculating the C/BD ratios of available sprocket sizes, and then placing the ratio figures in numerical order with the sprocket sizes listed beside the ratios. The chart is used after dividing the answer derived by the formula by the number of teeth on sprocket *A* and getting a "sprocket factor" figure. This SF figure is located in the chart, and sizes for *B, C* and *D* sprockets are noted to the right of the SF figure. A portion of a chart that uses sprocket sizes 6 through 16 and 24 teeth is found in Table 2.

The fertilizer rate-per-acre of the hose pump can also be changed by varying the number of hose used per row or by changing to hose that have larger or smaller inside diameters. Also, the output can be increased by using hose with greater wall thicknesses but with the same inside diameter. The above formula may be used regardless of size of hose on the pump if a count of reel turns per gallon is made for each

(Continued on page 542)

TABLE 2. SAMPLE SPROCKET-SIZE CHART FOR PUMP–DRIVE WHEEL RATIO WITH A FOUR SPROCKET CHAIN DRIVE. (C/BD = SF or Sprocket Factor)

SF	B	C	D	SF	B	C	D	SF	B	C	D	SF	B	C	D	SF	B	C	D
.0417	12	8	16	.0778	9	7	10	.1224	7	12	14	.1648	7	15	13	.2344	8	15	8
.0449	12	7	13	.0813	10	13	16	.1273	10	14	11	.1705	8	15	11	.2449	7	12	7
0.467	10	7	15	.0855	9	10	13	.1299	7	10	11	.1746	7	11	9	.2593	6	14	9
.0495	13	9	14	.0888	13	15	13	.1322	11	16	11	.1786	7	10	8	.2679	8	15	7
.0530	11	7	12	.0909	11	8	8	.1364	8	12	11	.1833	6	11	10	.2857	7	14	7
.0563	10	9	16	.0938	8	12	16	.1400	10	14	10	.1857	7	13	10	.3061	7	15	7
.0600	10	9	15	.0982	8	11	14	.1442	8	15	13	.1923	6	15	13	.3265	7	16	7
.0635	9	8	14	.1058	8	11	13	.1477	8	13	11	.2000	8	16	10	.3429	7	24	10
.0667	10	8	12	.1083	8	13	15	.1524	7	16	15	.2041	7	10	7	.3750	8	24	8
.0694	12	10	12	.1122	7	11	14	.1548	6	13	14	.2083	8	15	9	.4286	7	24	8
.0718	13	14	15	.1154	13	12	8	.1587	7	10	9	.2188	8	14	8	.4898	7	24	7
.0741	9	8	12	.1190	7	10	12	.1607	7	9	8	.2286	7	16	10	.6667	6	24	6

*Letters *B, C* and *D* refer to the number of teeth on sprockets in positions as shown in Fig. 5.

The Challenge in Farm Materials Handling

S. S. DeForest
Member ASAE

Labor-saving systems, not mere gadgets, are needed to solve materials-handling problems on farms. To integrate existing buildings with available equipment into an organized system of materials flow is an engineering challenge.

ELIMINATING inefficiency around the barn and farm lots involves efficient procedures and equipment in handling all materials on the farm, including forages, grains, water, purchased supplies, finished products and manure.

Industry is making great strides in solving its problems of handling materials. Engineers in industry make studies to determine the pattern of materials flow around their plants. Conveyors, elevators and other machines replace human locomotion. Old machines, made to do one job, are replaced with new, faster ones while others do a number of operations without being helped by human workers.

Industry is finding that facilities, more than adequate in the past, are now costly and inefficient to operate. Some companies cannot economically convert their present facilities to the top efficiency needed, so they start all over again by building a new plant employing the genius of automation to lower production unit costs.

How can this be applied to farms?

Until the present time, through efforts by power suppliers, state colleges, smaller manufacturers, and farmers themselves, materials-handling problems on farmsteads have been attacked by buying bigger pitch forks, installing electric motors, or adding a shed to the barn. Little work has been done in analyzing the over-all problem, from an engineering viewpoint as industry has done. The development of "gadgets" has solved some problems but farmers need more than this. They need whole systems revised.

Agriculturally speaking, it is doubtful if the degree of automation that is possible in industry can be attained. One reason is that farming deals with animals that may never be adapted to so-called automatic systems or machines.

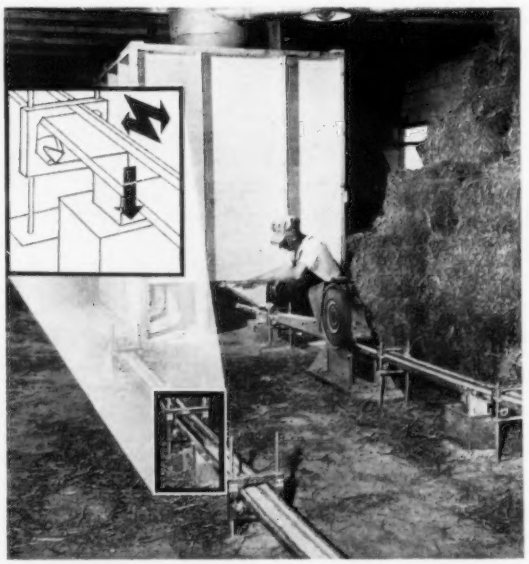
On the other hand, there has been amazing progress, and in view of this apparent progress in some areas and on some farms, why have farmers, by and large, been able and willing to spend money for field machinery, and more and bigger tractors, and yet neglect the problems in and around farm buildings?

There are two answers to this. First, they can see more immediate benefits from investing their money in crop-production equipment. They see more bales of hay in the barn before it has been rained on; they see less corn left in the field; their corn is planted before the neighbor's, or they can farm more acres.

Second, materials-flow problems in the field are easier to solve. Each new machine is tailor-made for any farm. It fits without complications. Installing a productive machine in or around farm buildings, however, usually requires a custom-built operation. Converting farmsteads to highly efficient production plants is basically a problem in farm structures; though it does not by any means exclude specialists in machinery or rural electrification.

In a recent series of articles *Successful Farming* stressed the need for *basic planning* in solving farm materials handling problems. The approach used was to state principles and illustrate them with actual farm installations as follows:

- *Don't move it.* Or, move materials as little as possible. Store materials where they will be consumed. Shorten distances. Let animals self-feed.
- *Handle larger amounts.* Make every trip count. Throw away the scoop, pitch fork, basket and eliminate small batches.
- *Make flow continuous.* Use machines and gravity to move materials automatically.
- *Condense it.* Reduce the bulk and weight of materials. Change their shape for easy handling.



This shaker type poultry feeder is adapted to conveying feed to a milking parlor, using the continuous flow principle. Each stall has a chute from the feeder above. Jerks of the trough move the feed from one chute to the next until all chutes are full. An automatic shutoff stops the motor

The farmer realizes he has a problem in handling materials around his farmstead. But, he is rapidly approaching the point where he needs help from agricultural engineers. He needs suggestions and methods to help him pull together numerous labor savers into an integrated, engineered system. And herein lie the real problems.

There has been far too little engineering done in establishing the pattern of materials flow on farms. Agricultural engineers need to determine *how* materials must get from here to there and pinpoint the problem areas ac-

Paper presented at the annual meeting of the American Society of Agricultural Engineers at Urbana, Ill., June, 1955, on a program arranged by the Farm Structures Division.

The author—S. S. DeForest—is associate editor, *Successful Farming*.

(Left) Corn and protein supplement are mixed in the corncrib and augered to the silo shed. Here silage, thrown down by silo unloader, is mixed with corn-protein in hopper, and all is conveyed to bunks. Short chutes from auger to bunk are filled, starting near the silo. Feed passes over full ones and fills the others in continuous flow • *(Right)* Self-unloading wagon delivers feed to bunk feeders

cording to farm enterprises. Then designers will have a common basis from which to start the development of buildings and equipment. As the situation exists today, manufacturers have difficulty in designing new buildings and machines. They may even hesitate to start designing because of the extreme variations of situations these proposed designs are required to fit.

Buildings now on farms, and far too many new ones being built, lack flexibility for conversion to alternate uses. They lack overhead clearance for efficient use of power equipment, or supporting posts are in the way. Often buildings are in the wrong location for integration into an organized system of materials flow.

Suppliers of buildings should be selling farmers more than *shelter* for agricultural products or machinery. They should *sell a shell,* adaptable for any farm use where its flexibility will not be limited by posts, door size and placement, or location of the building itself. Further, it should be sold with optional features for systematizing it for any farm enterprise. It might be a system for grain storage, grinding, blending or mixing. It might be a loose-housing dairy system, a stanchion-barn system, or other. The important feature should be its convertability to other farm uses. It would seem that manufacturers of prefabricated farm buildings are in a position to supply such buildings. It would likewise seem to be an opportunity for manufacturers of tractors, grinders, conveyors, elevators, and storage bins to design standardized materials-handling equipment to fit these buildings. It is essential that a farmer end up with not just a building, but a flexible, engineered system, designed for future changes in agriculture, changes in farm ownership, and changes in farm enterprises.

There is a lack of materials-handling equipment designed especially for farm use. Farmers are forced to search far and wide for conveyors they can use in the barn or between barns. Suitable weighing and measuring devices are also difficult to find. The equipment a farmer can find is often not adaptable to his use and is too long, too wide, or too expensive.

The equipment now available cannot be put to enough use. Industry has found a fork-lift truck to be virtually indispensable in transporting materials around factories on pallets. A large percentage of farms, too, have a fork-lift truck. But it is used almost exclusively for loading manure. This tool should be put to more uses. It seems the pallet system, or a variation of it, would have much farm application. If it does there is a need for a new type of tractor—one with large front wheels and made especially for lifting, stacking, hauling, scooping, and scraping.

There is need also for one elevator for doing all the elevating jobs whether it be grain, silage, hay, fertilizer, or sacked feed.

There's a need for an inexpensive conveyor to integrate farm buildings into one unit. The automatic poultry feeder might be used as a conveyor between buildings as well as within them.

A different wagon is used to unload manure, silage and ground or mixed feed. Several companies are making progress in the design of a unit that will handle all hauling and unloading jobs. More work is necessary along this line.

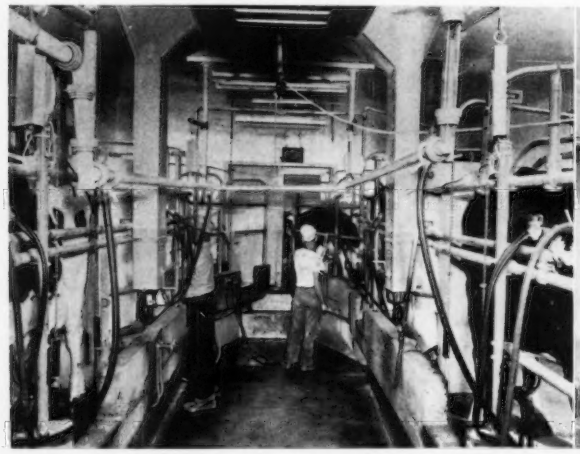
Better ways to finance materials-handling equipment are needed too, although there are recent developments that help the farmer toward this end. He can secure a farm-storage-facility loan through his bank or county Agricultural Stabilization and Conservation office to remodel or build new grain-storage units. Interest is four percent and he has four years to pay off the loan. It is the author's understanding that, if elevators or conveyors are an integral part of the storage unit, they can be included in the total cost. Up to 80 percent of this cost may be borrowed.

A storage-equipment loan is available, too, which includes provision for borrowing money for drying equipment. A farmer can borrow up to 75 percent of his cost for this equipment and pay off the loan in three years.

This help is minor in comparison with the farmer's financing needs. There is nothing available comparable to the financing that industries use to build new, highly efficient plants of production.

New developments which require utilizing and increasing quality of agricultural products also complicate handling problems, as shown by the following examples:

1 The system for utilizing cornstalks as silage after the



During milking, cows are held in a 14x50-ft holding pen and enter the parlor, with little help, two at a time when doors open. Feed and water are handy. Milk goes by continuous flow through a pipe line to a bulk milk tank.

This farmer does his feed grinding with a portable grinder near his storage bins. His unloading wagon mixes the feed and then, with the help of the elevator, places it above the stalls, ready for use in the parlor

grain has been harvested. Harvesting, storage, and handling of stalks and grain will require treatments not now common on many farms.

2 The possibility of storing and feeding hay and other whole plants as pellets. In pellet form, the materials flow like grain and can be stored, dried, and handled by buildings and equipment of types used for grain.

3 The possibility of packaging silage in plastic bags and storing and handling it similarly to large bales of hay. This might suggest more use for a pallet system of materials handling.

As has been indicated, the farmer is in a position where he cannot move forward faster in solving his materials-handling problems. He is caught between inefficient, poorly located buildings and lack of available materials-handling equipment designed especially for farm use.

He has many labor savers and is interested in more. But he lacks help in integrating them into a system. Agricultural engineers are in a position to take the lead in developing the basic fundamentals and in designing buildings and equipment to fit farmers' materials-handling needs.

Multiple-Discharge Fertilizer Pump

(Continued from page 539)

size of hose. More information on calibration is given in USDA Farmers' Bulletin No. 2096, entitled Hose Pump for Applying Nitrogen Solutions.

Other Characteristics

The output of the hose pump will vary slightly with a change in temperature of the liquid. In laboratory tests the output increased 4 percent with a temperature change from 70 to 100 F. There is also a variation in output due to change in head of the fertilizer solution in the supply tank. (Fig. 6). The output of the hose pump will decline slightly as the tubes age. This can be compensated for by an occasional recalibration; that is, by recounting the number of reel turns per gallon and calculating new sprocket sizes.

The pump must be used with either a vented tank or with a closed tank which is equipped with a pressure-regulating device to maintain a constant pressure within the tank because a change in tank pressure will change the output of the hose pump. In laboratory tests with a pressure of 12 psi in the tank, the output was approximately twice that of the same pump with no pressure in the tank. With the hoses that are presently supplied with the pump, the hose pump can be used only with fertilizers or other chemicals that have less than 30 psi vapor pressure and cannot be used with anhydrous ammonia.

To maintain a constant rate per acre with a varying speed, the hose pump should be used with unrestricted outlets. For that reason, the usual speed-output characteristics of the hose pump will be altered when spray orifices are used in the outlets. However, with proper calibration and by driving the pump reel at speeds of from 300 to 450 rpm, it will serve as a sprayer. At normal hose tension a pressure of from 20 to 30 psi can be maintained depending on the speed of the reel.

Normal hose tension, which is just enough to close the hose and prevent the flow of fertilizer when the pump is stopped, stretches the hose by about 15 percent of its unstretched length. That is, a 10-in section of unstretched hose will be about 11½ in long when stretched over the pump reel in an operating position.

The effects on output by changes in temperature and changes in head pressure can be lessened by putting more tension on the hose. For more accurate distribution when working with widely varying head, it is recommended that the hose tension be increased to as much as 80 percent elongation or that an unstretched section of hose will be stretched to almost twice its length. This increased tension will shorten the life of the hose. The effects on output due to temperature and head changes can also be lessened by using hoses with wall thicknesses of $\frac{3}{32}$ in. However, the thicker ($\frac{3}{32}$ in) walled hose generally will have shorter life than the $\frac{1}{16}$ in wall hose.

Determining Irrigation System Capacity

James E. Garton
Assoc. Member ASAE

ONE of the basic problems in the design of any irrigation system is the determination of the capacity of the system. If the system is overdesigned, a larger than necessary investment in equipment is thereby required. On the other hand, if the system is underdesigned, crop yields will be less than the potential production. In between these two extremes for a given crop in a given location is a rather narrow range of values which must be met if proper design is to result.

Three factors determine the capacity of the system. They are *(a)* hours of operation, *(b)* water-application efficiency, and *(c)* the daily moisture use for the irrigation frequency used. Fig. 1 is a nomograph which relates these variables. In the example, we assume that a crop will use 0.25 inch of water per day during the peak-use design period, that the application efficiency will be 70 percent, that the system will operate 22 hours per day, seven days a week; and, as soon as one irrigation is finished, another can begin.

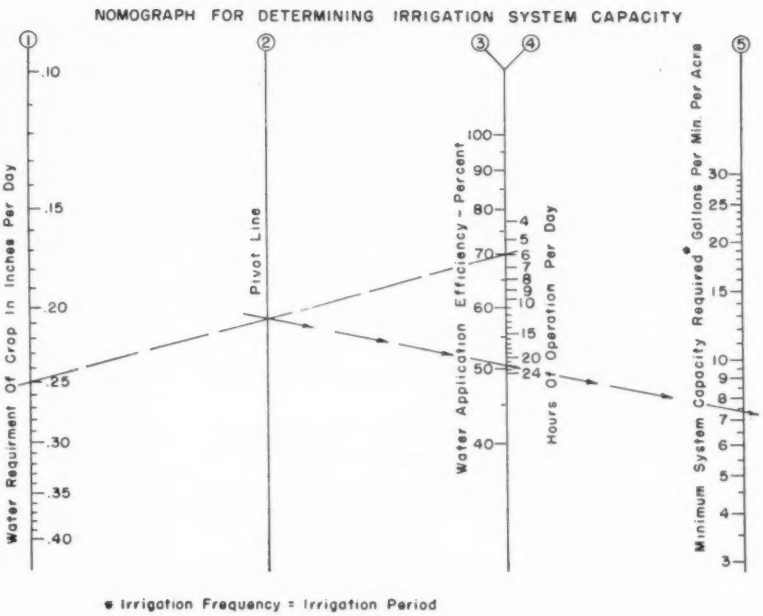

NOMOGRAPH FOR DETERMINING IRRIGATION SYSTEM CAPACITY
Water Requirment Of Crop In Inches Per Day
Pivot Line
Water Application Efficiency - Percent
Hours Of Operation Per Day
Minimum System Capacity Required* Gallons Per Min. Per Acre
* Irrigation Frequency = Irrigation Period

Fig. 1 Nomograph for determining irrigation system capacity

Paper prepared expressly for AGRICULTURAL ENGINEERING. Approved as Journal Manuscript No. 264 of the Oklahoma A. & M. College.

The author—JAMES E. GARTON—is associate professor of Agricultural Engineering, Oklahoma A. and M. College.

Draw the broken line from 0.25 on scale 1 to 70 percent on scale 3. From the intersection of this line on scale 2, draw the line of arrows through 22 hours per day on scale 4 and read on scale 5 that a minimum capacity of approximately 7.4 gallons per minute per acre will be required.

The nomograph shown as Fig. 2 can be used for scheduling irrigation.

If the water requirement of the crop per day is known or can be estimated from irrigation guides or other sources, enter scale 1 with this value. Then draw the broken line through the water-application efficiency on scale 2 and intersect the pivot line. From this intersection, draw the line to the gross depth of water applied to the field (scale 5).

On scale 4, can now be read how many days the moisture will last before another irrigation is required. In the example, if 3 inches of water are applied with an efficiency of 70 percent and the crop uses 0.25 inches of water per day, the field will need to be irrigated about every 8½ days if no rainfall occurs.

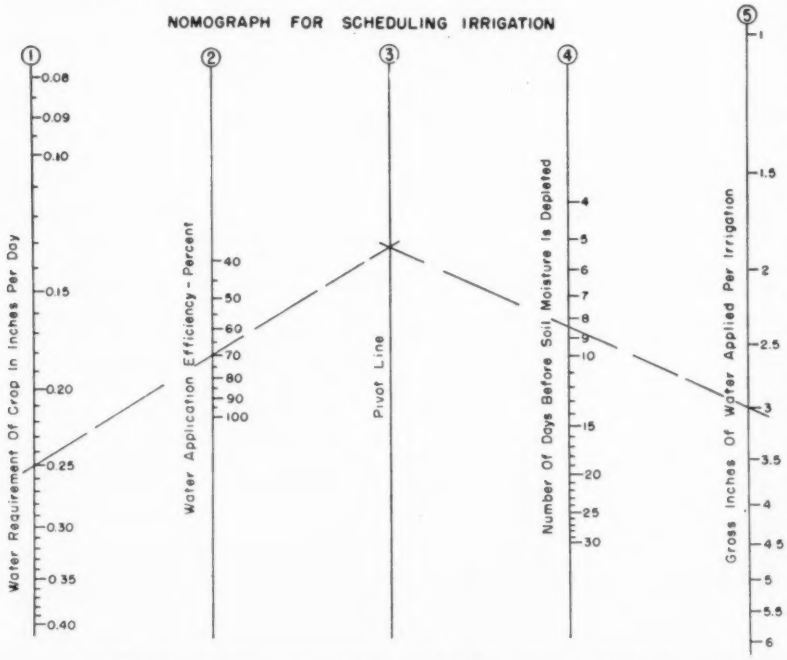

NOMOGRAPH FOR SCHEDULING IRRIGATION
Water Requirement Of Crop In Inches Per Day
Water Application Efficiency - Percent
Pivot Line
Number Of Days Before Soil Moisture Is Depleted
Gross Inches Of Water Applied Per Irrigation

Fig. 2 This Nomograph can be used for scheduling the application of irrigation water

Cattle Neutral on Feed Grinding Methods

R. W. Kleis and A. L. Neumann
Assoc. Member ASAE

IN THE process of developing automatic feed-handling and processing systems, it was believed desirable to determine whether type of grinder used had any significant effect on the response of beef cattle to the feed. There were many farmers and others who felt that it did.

Different types of feed grinders can be modified and adjusted to produce, within practical limits, any desired degree of average fineness (fineness modulus). At any given fineness modulus, however, different mills produce quite varied distributions of particle size (moduli of uniformity). The specific objective of this work, then, was to determine the effects of variations in uniformity of grind by different types of grinders. The criteria used to evaluate these effects were feed consumption and rate of gain.

Three independent 56-day feeding tests were completed as follows:

- Ear corn ground to equal fineness moduli in a hammer mill and a burr mill was blown through 200 ft of pipe with an auxiliary blower to exaggerate flouring and fed to two randomly selected lots of 10 steers each. (1953 tests)
- Ear corn ground to the same fineness by a hammer mill, a burr mill, and a knife mill was used to finish three lots of 10 steers each. None of this feed was run through an auxiliary blower. (1954 tests)
- Shelled corn was ground with a hammer mill and a burr mill and fed to two lots of eight steers each for finishing. (1955 tests)

Paper prepared expressly for AGRICULTURAL ENGINEERING.

The authors—R. W. KLEIS and A. L. NEUMANN—are, respectively, assistant professor of agricultural engineering and professor of animal science, University of Illinois.

Authors' Note: The investigation reported here was conducted jointly by the animal science and agricultural engineering departments of the Illinois Agricultural Experiment Station as part of a larger project involving the application of electric power to farm operations to reduce chore labor. The over-all project is supported cooperatively by the Illinois station, the U.S. Department of Agriculture, and the Illinois Farm Electrification Council.

Agricultural experiment station study reveals no significant differences in feed consumption or gains of beef cattle from feed ground in three different types of mills

Test Procedure

The three grinder units used in the various tests were operated with 5-hp electric motors as part of the automatic system developed at the University of Illinois, which is now being commercially built and sold. The corn was fed into the mills uniformly with a mechanical unit, and the operation was controlled by an automatic electrical control unit. The feeds were ground each week from a common supply of corn, and triplicate samples of each batch were analyzed for moisture content, fineness moduli, and moduli of uniformity.* The mills were adjusted to provide equal fineness moduli.

The steers for each lot were selected to permit valid statistical analyses of resulting data. They were fed in dry lots that were identical in size, shelter, and arrangement. Each lot was fed all it would clean up twice daily. Lot weights were taken each week, and individual steer weights were taken at the beginning and end of each test period.

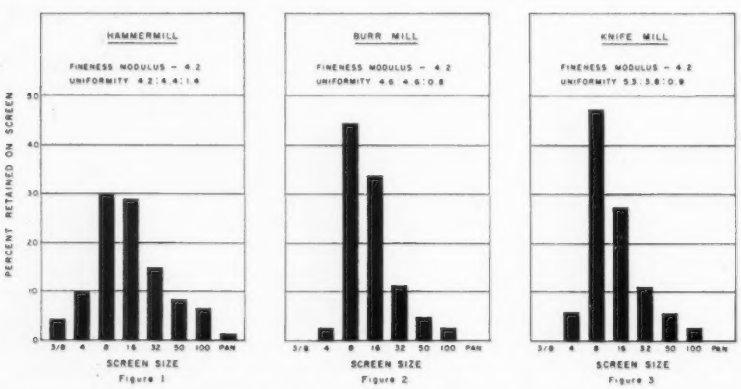
Analysis

The fineness moduli and moduli of uniformity of the feeds were analyzed statistically by the analysis of variance procedure† at the 5 percent level of significance. There was no indication that the fineness moduli involved in the various comparisons were not identical. There was, however, a considerable amount of difference in the uniformity of feeds prepared with the different mills (Figs. 1, 2 and 3). This then was the primary variable being tested.

Modulus of uniformity is not always an accurate indication of distribution of particle size. For example, the modulus of uniformity (4.6:4,6:0.8) shown in Fig. 2 would be exactly the same if the percentages of material retained were 16, 15, 15, 23, and 23 on the ⅜, 4, 8, 16, and 32 screens. This, however, would be much less uniform than the actual retention of 0, 2, 44, 34, and 12 percent on these screens. For this reason the typical actual distributions are shown rather than listing the average moduli of uniformity.

As indicated in Figs. 1, 2, and 3, the feed ground with a hammer mill was least uniform of any in the tests.

(Continued on page 547)



Figs. 1, 2 and 3 Typical particle-size distributions for the three types of feed mills used in the University of Illinois investigation of feed-grinding methods

*A rotap machine, screen stack, and procedures recommended by the American Society of Agricultural Engineers were used to determine fineness moduli and moduli of uniformity.

†Procedure outlined in chapter 10 of Dixon and Massey, Introduction to Statistical Analysis, McGraw-Hill Book Co.

Multicombination Farm Building Design

L. W. Bonnicksen
Assoc. Member ASAE

A PROJECT was initiated by the Oregon Agricultural Experiment Station in 1955 on the development of new types of farm-building construction, the objective was to develop types of farm-building construction featuring: *(a)* economy of construction *(b)* suitability for many farm uses, and *(c)* ease of alteration to meet changing farm requirements. It was the thought that buildings using types of construction incorporating these features would greatly aid the farmer in obtaining a larger net income. The following procedure for the project was employed:

- Develop preliminary designs of various types of construction
- Prepare detailed plans and analysis of the best preliminary designs
- Construct pilot buildings and individual building units for test purposes
- Analyze the test observations and alter plans where necessary
- Evaluate critically the feasibility of each type of construction.

One of the first steps in the developing of preliminary designs was to make the following hypothesis . In order for a type of construction to be economical, suitable for many uses, and easy to alter, it should consist of building parts from which many combinations of buildings can be assembled.

Paper presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1955, on a program arranged by the Farm Structures Division. Approved as Miscellaneous Paper No. 24, Oregon Agricultural Experiment Station.

The author—L. W. BONNICKSEN—is assistant professor of agricultural engineering, Oregon State College.

Fig. 1 Preliminary design (PD-1) consisting of panels supported on a rigid-pillar and rafter frame: (1) pillar, (2) shed rafter, (3) gable rafter, (4) cantilever rafter, (5) panel, (6) gable panel, (7) splatter panel, (8) silo and grain panel, (9) eave panel, (10) ridge panel, (11) rake panel, (12) corner panel, (13) splatter corner panel, (14) ridge cap, and (15) corner cap

Standardized, prefabricated panels for pole-type farm building construction provide variety in design combinations, together with expansibility and economy in assembly costs

The building parts should be:

- Prefabricated
- Interchangeable
- Standardized
- Kept to a minimum of different kinds of parts
- Made of low-cost readily available materials
- Easy to fabricate
- Easy to handle
- Easy to fasten and unfasten to other parts
- Durable
- Readily available for use

The buildings should be:

- Easy to assemble, alter, disassemble
- Have many combinations of size, shape, strength, support, and degrees of functioning, and be suitable for meeting the optimum requirements for a maximum number of farm uses
- Have a low original cost, low maintenance, high resistance to destructive forces
- Readily available and easily obtained for immediate use by the farmer.

The first preliminary design developed to any extent consists of panels supported on a rigid-pillar and rafter frame. Fig. 1 shows a sketch of this design, which is referred to as PD-1.

A unique feature of PD-1 is the panel scheme illustrated in Fig. 2. If $S=L$, $X=Z=Y$, and N=a whole number, the number of types of panels can be reduced to three—right-hand and left-hand gable panels, and a standard panel that can be used on the roof, side wall, or end wall. The roof slope under these conditions would be:

$$Z/L=X/L=\sqrt{1}/(N^2-1)$$

This shows that the roof slope is dependent on N, the number of panels per L. X, the width of the panels, is dependent on N and L.

$$X=L\sqrt{1/(N^2-1)}$$

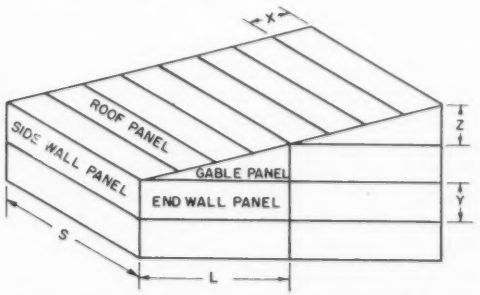


Fig. 2 Panel scheme for design PD-1. $N=(L)$/horizontal projection of $X=$number of roof panels per L

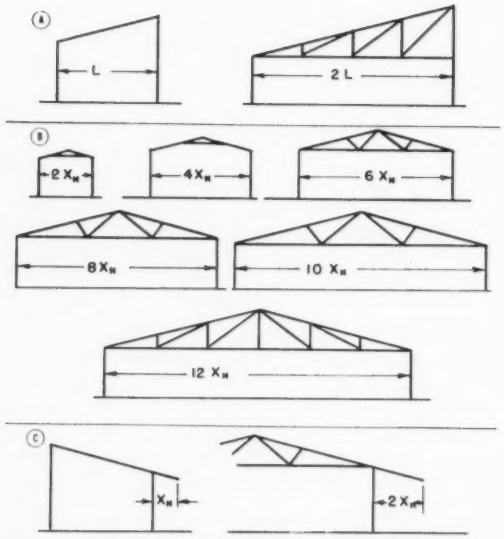


Fig. 3 Rafter types. X_H = horizontal width of roof panel: (A) shed type, (B) gable type, (C) cantilever type

The pillars are standardized as to height above ground level. The lowest pillar is established to give the desired door height, open wall height clearance, or wall height. Then the next pillar in the lateral direction is a distance *Z* higher.

The horizontal measurements of one pillar to another is from center to center including the side and end pillars. This is to allow for expansion of the building.

The rafters are hinged to the tops of the pillars. There is a rafter placed on each side of the pillar, except at the ends, where only the inside rafter is placed. There are three types of rafters: shed, gable, and cantilever (Fig. 3).

The roof and wall panels *(a)* support the roof and wall loads between the rafters and pillars, *(b)* are weathertight, and *(c)* have assembly joints which are weathertight.

The splatter panel is used for the lower part of the walls. These panels are able to withstand the extra conditions to which they are exposed.

The silo and grain panel is designed to withstand the lateral pressures of silage and grain. It has a vertical slope for silage, and the outside or vertical side is weather resistant.

Other panels that are used are partial panels and panels for windows, doors, and vents.

When the previously mentioned panels are assembled, they do not join at the intersections of the walls and roof. Thus special panels are needed at these points. These special panels are shown in Fig. 1, numbered 9 through 15.

These various building parts can be assembled into many combinations of buildings. The possible shapes are shed, gable, off-center, butterfly, gambrel, full and half monitor, sawtooth or a combination of these shapes. There are many combinations of width, height and length. Many combinations can be made with the various wall panels and cantilever rafters. By using different grades of materials and several panel lengths, various combinations of strength can be made.

With PD-1 as a basis, the detailed plans for four types of construction are being developed. These are the OSC 141, 142, 161, and 162 Farm Building Constructions. Fig. 4 shows views of the panels for these types of construction.

For the 141 and 142 FBC, *L*, the lateral spacing, is 14 ft; and *S*, the longitudinal spacing, is 14 and 16 ft. *N*, the number of panels per *L*, is 4; therefore, the roof slope is approximately 3.1 to 12. The width of all panels, *X*, *Y*, and *Z*, is 3 ft, 7⅜ in. The 14-ft long panels can be used on the roof, sidewall, or end wall. The 16-ft long panel can be used on the roof or sidewall.

For the 161 and 162 FBC, *L*, the lateral spacing, 16 ft; and *S*, the longitudinal spacing, is 16 ft. *N*, the number of panels, is 4; therefore, the roof slope is approximately 3.1 to 12. The width of all panels *(X, Y,* and *Z)*, is 4 ft, 1⁹⁄₁₆ in. These panels can be used on the roof, sidewall, or end wall.

The pillars for all four types of construction are pressure-treated, wood-sawed posts or round poles. The rafters are made from structural timbers and are fastened to the top sides of the pillars by a ¾-in bolt and a 4-in split-ring connector. The pillars are set into the ground to a depth of four or more feet on a gravel footing. The backfill material is gravel.

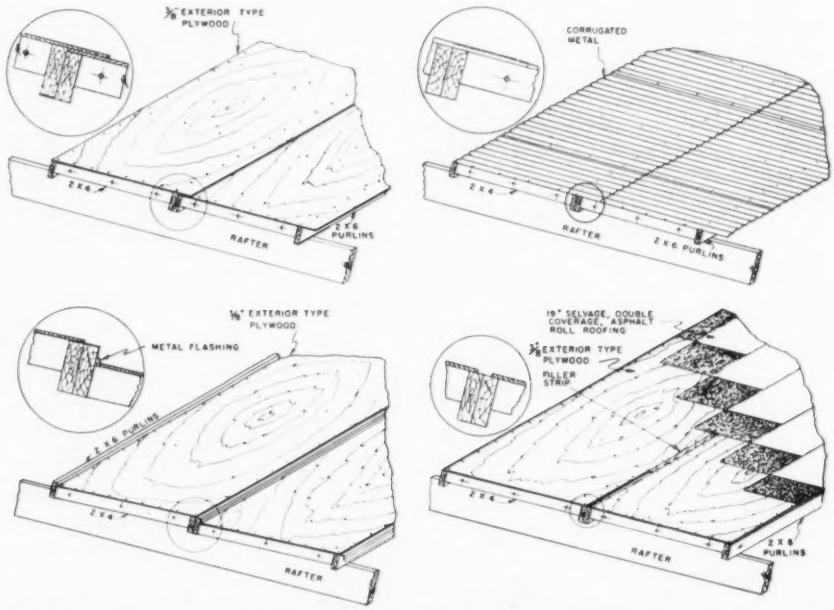


Fig. 4 Various types of roof panel construction. *(Upper left)* Plan OSC 141. *(Upper right)* Plan OSC 142. *(Lower left)* Plan OSC 161. *(Lower right)* Plan OSC 162

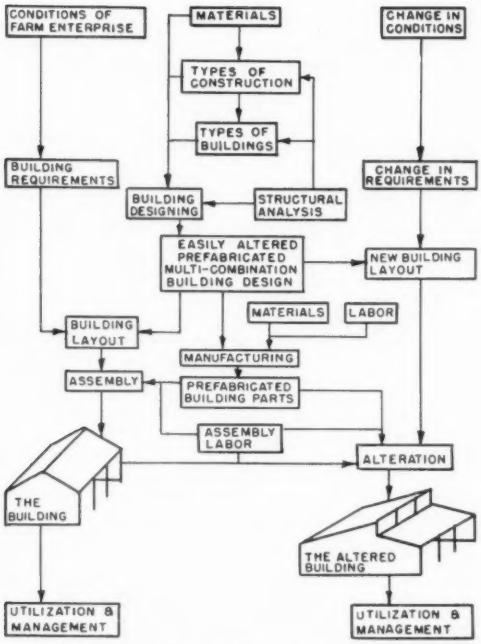


Fig. 5 Diagram showing how a prefabricated, multicombination building is designed, laid out for a specific set of requirements, manufactured, assembled, and utilized. It also shows the process of alteration when conditions change

The splatter panel is made of 2 x 12-in pressure-treated timbers.

The panels are fastened to the pillar and rafter frame by metal ties.

The panels can be insulated before or after assembly.

The parts of these types of construction are similar in many ways, and there is a degree of interchangeability among the four types.

A type of cantilever rafter which will hinge on the top of the outside pillar is being designed. One or two wall panels are fastened to this rafter. Then, by rotating the rafter, the panels can act as a cantilever roof or a sidewall.

These types of construction can be prefabricated by farmers; however, it could be more economically done by local manufacturers with a small investment in tooling. The assembly could be done by farmers, by local carpenters, or the manufacturers. These local manufacturers or carpenters could very well develop a business in the farm-building field similar to the business of a local farm-machinery dealer.

These types of construction are still in the development and testing stage. They have not as yet been evaluated for feasibility or approved.

Fig. 5 is a diagram of how an easily altered, prefabricated, multicombination building is designed, laid out for a specific set of requirements, manufactured, assembled, and utilized. It also shows the process of alteration when the conditions change.

The utilization of other materials and designs are still being developed. The prospects are good that other types of construction can be developed which will meet the objectives of this project.

Cattle Neutral on Feed Grinding Methods

(Continued from page 544)

That ground with the knife mill was slightly more uniform than that ground with the burr mill. The most extreme variability would be represented by equal percentages of feed retained on each screen. A completely uniform grind would result in 100 percent retention on a single screen. The knife mill most nearly approached a uniform grind with 47 percent of the feed retained on the No. 8 screen.

The data obtained from the test cattle were also analyzed statistically. The T test with modified degrees of freedom‡ was used to test for significant differences at the 5 percent level after each test. The complete series of tests were also subjected to an analysis of variance at the 5 percent level of significance. The differences in feed consumption and gain not only were very small, but were not consistent for any particular type of mill.

Conclusions

- The amounts of feed consumed did not differ significantly in any of the comparisons. The cattle refused some of the large cob particles in the hammermill feed, but this refusal did not affect total feed consumption.
- There were no significant differences in gains between lots of cattle fed feed prepared with the different mills.
- While a particular type of mill may have certain mechanical or operational advantages that will fit particular conditions better than will another type of mill, *neither gains nor feed consumption reflected any preference by cattle.*

‡Procedure outlined in chapter 9 of Dixon and Massey.

Teacher Migration to Industry

THE engineering colleges of the United States have experienced a net loss of three percent of their professors to industry within a two-year period, according to a report presented during the annual meeting of the American Society for Engineering Education at Iowa State College, June 27, by an industry committee headed by A. R. Hellwarth, assistant to director of employment, The Detroit Edison Co. This migration is taking place, it is said, at a time when the engineering colleges need 1,300 more teachers to carry the 1956-57 load.

During the two-year period more than 750 left engineering faculties for industry, however, 500 left industry for teaching positions. The 150 colleges and universities accredited by the Engineers' Council for Professional Development covered by the survey reported a gain in teaching strength from 8,000 to 8,400 during the period in spite of losses to industrial employers. The 1,300 present shortage would require the engagement of 15 additional professors or instructors for every 100 now teaching, it is said.

The committee queried all 150 engineering deans, received reports from 62 percent, and extended these results to arrive at national figures. According to the deans, some teachers are being recruited by industry and others are seeking industrial employment for various reasons. Eighty percent of the deans replying felt that higher salaries were the main reason for loss of teachers. Some are seeking greater opportunities and new experience.

Direction Control in Deep-Well Drilling

R. H. Painter

Methods of measuring deflection during drilling in deep water well holes at regular intervals keeps the hole straight, thereby reducing pump maintenance, increasing pump efficiency, and insuring against curves that restrict pipe entrance

DEEP-WELL turbine pumps, especially the line-shaft type are allergic to a crooked hole, because they require that all the energy of the motor on the surface be transmitted to the bowls or pumping unit by means of a lineshaft. This shaft is generally made up in 10-ft lengths for ease in handling. Careful checking is made in its manufacture to insure that it is perfect, *i.e.*, straight, concentric, and the ends absolutely square for coupling together each successive piece.

As the shaft is installed in the pump, a journal or bronze bearing is placed at intervals of 5 ft. Clearance between bearings and shaft are generally set at 0.007 in.

Over the past 15 years turbine-pump manufacturers have made great strides in improving pump efficiency and operation by building into their pumps all the precision possible. In some instances they have raised efficiencies, which reduce the cost of pumping water by more than 20 percent.

The large friction losses occur in the motor (9 percent), in the bowls or pumping unit (13 percent), and in the lineshaft (1½ to 4 percent). If for any reason the shaft is placed in a bind, the efficiency will be lowered due to the increase in horsepower required to turn the pump. Continual running of the pump in this restricted manner will cause accelerated wear on the bearings, and if left for a short period might destroy the whole lineshaft assembly and the bowls. There are pumps in this area that are pulled six times a year to replace bearings, lineshaft, and bowls. The cost of repairs is approximately $4600 for each pull.

Such an expense can be eliminated by drilling a straight hole to the maximum depth it is intended to set the pump for the life of the well.

The importance of a straight hole is illustrated by Fig. 1. The accompanying drawings are of actual wells located on the property of the Salt River Valley Water Users Association. Fig. 1A illustrates a straight well all the way to the bottom. In Fig. 1B it will be noted that the well makes a sharp turn above the water table. The column pipe of the pump cannot make the turn. The water table is at 230 ft, and even though the well has plenty of water, the pump cannot reach it. Fig. 1C shows a pump setting at 300 ft which insures satisfactory operation.

Evaluating these different wells, all of which were drilled to a depth of 1,000 ft, at a cost of $20,000 per well, it is obvious that the well shown in Fig. 1B is a total loss.

In the well shown in Fig. 1C the pump can be set to only 300 ft. The water levels in the area of this well are falling at the rate of 15 ft per year. The present water level is

Paper presented at a meeting of the Pacific Coast Section of the American Society of Agricultural Engineering at Tucson, Ariz., December, 1955.

The author—R. H. PAINTER—is supervisor, pump department, Salt River Valley Water Users Assn., Phoenix, Ariz.

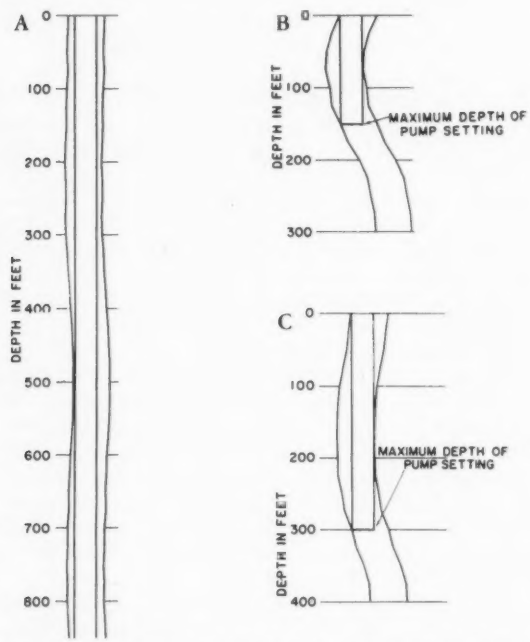


Fig. 1 The importance of a straight hole is illustrated by drawings of actual wells located on the Salt River Valley Water User's Association property. Well A has a straight hole all the way to the bottom. Well B has a sharp turn above the water table, and even if the well has plenty of water at 230 ft, the pump can not reach it. Well C will provide satisfactory operation as long as the water table stays above 300 ft. NOTE: Location of water table in both wells B and C is at 230 ft.

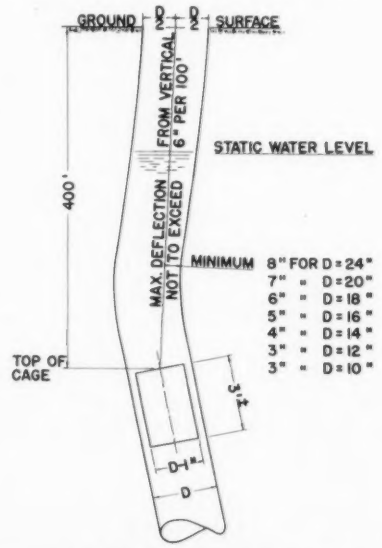


Fig. 2 Recommended deflections from vertical are given for various hole diameters

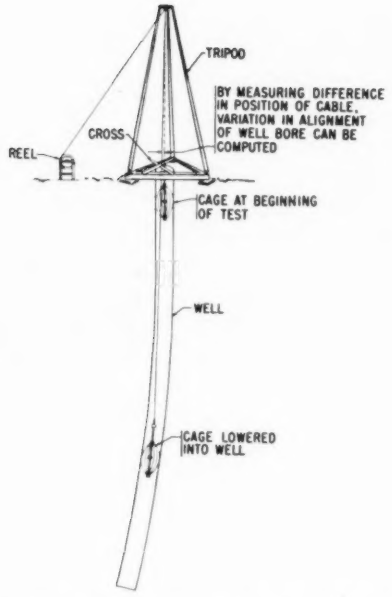

TRIPOD
BY MEASURING DIFFERENCE IN POSITION OF CABLE, VARIATION IN ALIGNMENT OF WELL BORE CAN BE COMPUTED
CROSS
REEL
CAGE AT BEGINNING OF TEST
WELL
CAGE LOWERED INTO WELL

Fig. 3 A method called "caging" is used for measuring and controlling deflection of a hole below the water level

Fig. 4 A plastic model which permits the insertion of plates at intervals showing departure from the vertical

250 ft, and with a maximum setting of 300 ft, the difference is 50 ft, and $50 \div 15 = 3\frac{1}{3}$ years that the pump can pump from this well. Therefore, the cost per year would be approximately $6,000.

The well in Fig. 1A can hold a pump to any depth desired. The life expectancy of the casing in this well is approximately 20 years or more.

From the accompanying illustrations and a comparison of yearly costs, it will be apparent why a set of plans and specifications should be drawn up for the protection of the pump purchaser.

Such plans are not difficult. They consist of only two straight lines parallel to each other, an equal distance apart, to a depth of the required maximum pump setting which is measured by the rate the water table is lowered each year. (Fig. 2 indicates recommended restrictions.)

The method used by our association for checking the driller, as he drills, is called "caging". The term is derived from an item which looks like a wire basket or cage that is part of the equipment used.

After the driller has passed the water level, one can no longer see what is happening. At this stage a method is used to measure and control the deflection of the hole. The "cage" is a heavy wire, oval-shaped affair that can be adjusted in midrift circumference to the size of the well casing (Fig. 3). It is heavy enough to carry it down easily through the water. The cage is attached to a small cable running through a pulley at the apex of a tripod, which is clamped securely to the casing. The legs of the tripod are adjustable, so that the cage can be centered exactly in the well. A cross is laid on top of the casing with two edges of the quadrant one inch south and one inch east of the cable and made secure so that it cannot move. The cage is then lowered into the well and at various intervals measurements are taken from the edge of the cross to the cable, and any deviation from its true center can be computed by the formula of similar triangles to determine the amount of deflection.

Following the computations, a drawing of the east-west and north-south views is made on graph paper. A cut of a pump made to the same scale as used in drawing the well is laid in the well to see exactly how it may perform.

In the event the east-west or north-south deflection views appear excessive, that is, beyond specification tolerances, then the component of these two views may be plotted or arranged in a plastic model. This model (Fig. 4) becomes a 3-dimensional replica of the drilled well.

The drillers working under our specifications will work a little slower and charge a little more per foot for drilling. In most cases, it is about $1.00 per foot more. We do not object to this because it is more than offset by reduction in the number of pulls for damaged pumps, due to crooked holes, plus the fact we have a guarantee that our pump can always be set at any point in the well.

Since we have resorted to controlling our drilling operations, by checking the driller as he proceeds with the drilling our maintenance costs have dropped more than 40 percent on a straight hole as compared to a crooked hole.

Tubeless Tires on Earth Movers

THE Caterpillar Tractor Co. has announced that tubeless tires are being offered as standard equipment for the first time on many of the company's wheel-type earthmoving machines.

According to the announcement, this innovation in earthmoving tires is offered at no increase in price, and was brought about to reduce machine down time caused by tire and tube failure. It is reported that a recent survey conducted by a large tire company showed that 6 percent of a contractor's down time is caused by tires. Such features as cooler running, easier repair, no tube pinching and slower loss of air after puncture were listed in favor of the tubeless tires.

Weed Control in the Row

J. B. Liljedahl, W. M. Carleton and D. M. Kinch
Member ASAE Member ASAE Member ASAE

An investigation of a method for damaging weed seeds in a machine, which throws soil containing weed seeds against an impact plate by means of a rotating impeller, revealed some interesting results

A MAJOR problem at present in the production of sugar beets is in thinning the beets and in controlling the weeds in the row during the first two months after planting. Johnson (4)* reports that in 1946 this task required 32 man-hours per acre and was the largest cost item in the production of sugar beets in Michigan. Mechanical thinning can reduce this labor item by approximately 40 percent (3). About 15 percent of the sugar beet acreage was thinned mechanically in 1954 in Michigan and since there was an estimated 95,000 acres there still remained 2 to 3 million man-hours of labor for thinning and weeding sugar beets.

Considerable work in the Michigan State University agricultural engineering sugar beet research program has been directed toward the development of possible methods of sterilizing a strip of soil in which the sugar beet seed could be planted (5,6). Several possible methods of sterilizing the soil were considered: *(a)* mechanical energy, *(b)* heat energy by conduction, *(c)* ultrasonic energy, *(d)* high current electrical energy, *(e)* light energy, *(f)* high frequency electrical energy.

Experimental Soil Sterilization Work in Laboratory

The first three of these methods were considered to have sufficient merit to warrant experimental investigation. It was assumed that complete sterilization of the soil strip would not be necessary since temporary control is of primary importance.

Heat Energy: A 12-in layer of untreated soil from a sugar beet field was placed in a greenhouse box and the distance below the surface from which each weed germinated was determined. This information, shown in Table 1, was useful in determining the depth of soil which would need to be processed.

TABLE I. EFFECT OF DEPTH ON GERMINATION OF WEED SEEDS

Depth, Inches	Percent of all weed seeds germinating at each depth
0 - 1/8	29
1/8 - 1/4	32
1/4 - 3/8	20
3/8 - 1/2	10
1/2 - 5/8	6
5/8 - 3/4	2
3/4 - 7/8	1
7/8 - 1	0

It appeared from this single preliminary test that it would not be necessary to sterilize the soil deeper than ¾ in.

Common mustard seed was used to determine the time-temperature relationship when sterilizing the soil by heat energy. Mustard seed was used because in size it approximated many weed seeds and because its germination characteristics could be predicted. By immersing the seed in hot water baths of various temperatures for various lengths of time it was found that 150 F for one minute gave 100 percent reduction in germination.

From a practical standpoint, it was estimated that to sterilize, by heat, a strip of clay loam soil ¾-in deep by 4 in wide it would require approximately 55 Btu per foot of row. This would require roughly 17 gal of fuel oil per hour for a 4-row machine traveling at 2 mph.

Ultrasonic Energy: A 50-watt, 5-megacycle oscillator was used to activate a transducer which generated an ultrasonic field into which the mustard seed was introduced. Because of the low efficiency of the electrical equipment and the transducer, only about 14 percent of the original energy was received by the seed being treated.

It was concluded that sterilization of the seed by ultrasonic energy was possible, but that the effect was almost entirely that of heating.

Mechanical Energy: Seed of any kind, including weed seed, appears to be susceptible to mechanical damage when quite dry and brittle or when it is just about to germinate. The weed seeds most likely to compete with sugar beets are those about to germinate. Most others are in a dormant state and may stay that way for years.

A small laboratory centrifugal machine was constructed to mechanically

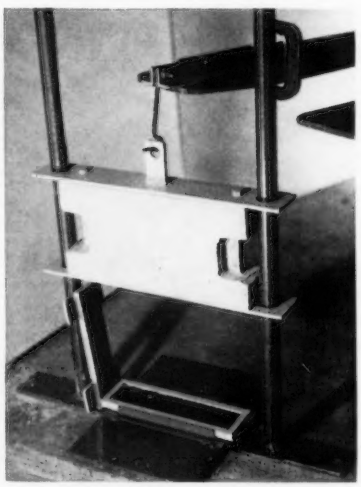


Fig. 1 Trip hammer for subjecting thin layers of soil to impact energy

Paper presented at the winter meeting of the American Society of Agricultural Engineers at Chicago, Ill., December, 1954, on a program arranged by the Power and Machinery Division. Authorized for publication as Journal Paper 1911 of the Michigan Agricultural Experiment station.

The authors—J. B. LILJEDAHL, W. M. CARLETON and D. M. KINCH—are, respectively, assistant professor of agricultural engineering, Purdue University, formerly special research assistant in agricultural engineering, Michigan State University; professor of agricultural engineering, Michigan State University; and, head of agricultural engineering, University of Hawaii, and formerly special research assistant in agricultural engineering, Michigan State University.

Acknowledgments: The authors gratefully acknowledge the financial assistance of the Farmers and Manufacturers Beet Sugar Assn. of Saginaw, Mich., and the advice, assistance and cooperation of Buford Grigsby, professor of botany and plant pathology, and Earl Erickson, associate professor of soil science, both of Michigan State University.

*Numbers in parentheses refer to the appended references.

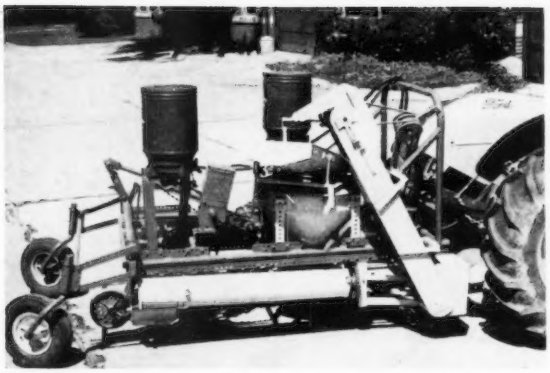


Fig. 2 Two-row sugar beet planter equipped to mechanically process a soil strip for one row

shock the seed. Mustard seed again was used. The centrifugal device consisted of an impeller rotating on a vertical shaft. The impeller consisted of a flat circular plate 11 in in diameter on which two vanes were welded. The seeds were fed into the center of the impeller and thrown by centrifugal force against a vertical steel impact plate. The speed of the impeller could be varied from 3000 to 4800 rpm.

When the seeds were soaked, but had not been allowed to germinate, there was no appreciable reduction in the germination of the seed at any speed of the impeller. After the seeds had germinated 40 hr the germination was reduced to zero when the seeds were processed at 4800 rpm. At 48 hr the germination reduction was complete if processed at 4000 rpm.

TABLE 2. GERMINATION REDUCTION OF BABY LIMA BEANS AS A FUNCTION OF VELOCITY AND MOISTURE CONTENT. DATA BY BAINER AND BORTHWICK (1)

Moisture content, percent	Germination reduction, percent At 750 fpm impact velocity	At 1550 fpm impact velocity
5.8	41	95
9.6	19	77
14.1	3	23
15.9	1	9

A similar study on lima bean germination by Bainer (1) indicated that germination reduction is a function of the moisture content of the seed and its velocity upon impact. In the case of lima beans the moisture content was well below that required to begin germination of the seed and is not typical of weed seeds in the soil. Even though it is not typical, the information still is of interest.

The same principle of damage by impact is used by The Safety Car Heating and Lighting Co., Inc., of New Haven, Conn., in their centrifugal machine called an Entolator (8). Its purpose is to destroy insects and insect eggs in wheat and flour and according to Cotton (2) it appears to be very effective.

Impact Device

A trip-hammer-like device shown in Fig. 1, was constructed to subject thin layers of soil to impact energy in the greenhouse. By varying the thickness of the soil being treated and the height of the weight being dropped it was possible to obtain a wide range of energy levels imparted to the soil. This energy range was from 60 to 7000 ft-lb per pound of soil. Two soils, Carlisle muck and Brookston clay loam, were processed at ⅛ and ½-in thickness. Both soils were badly infested with weed seeds.

At the lowest energy rate of 60 ft-lb per pound of soil there was a reduction (not significant) in the weeds which grew as compared to the check plot, but as the impact energy increased the weed count was again approximately the same as the check plot.

Field Machine

Design: In 1953 a machine was built which would mechanically treat and plant one row in the field and at the same time plant a check row. A 2-row sugar planter was used as the basic machine, one row of which was left intact to plant a check row. (Figs. 2 and 3)

The treatment side of the 2-row planter consisted of a depth wheel and a rotor to pick up the soil and throw it into an elevator which lifted the soil approximately 3 ft to deposit it upon a vibrating screen to remove the large stones. From the screen the soil dropped into the center of the impeller where it was thrown outward to strike an impact plate. From there the soil was collected and deposited in a band either in front or behind the planter. A small knapsack sprayer was mounted in a position so that any desired chemical could be added to the soil in addition to the mechanical treatment.

The sugar beet seed was planted from conventional planter boxes at a normal rate of one seed segment per inch of row at a depth of 1¼ in.

Impeller: The mechanical soil processing impeller (Fig. 4) consisted of a 20-in diameter flat plate rotating on a vertical shaft. Four radial blades of 2 x 2-in angle iron were attached to the plate. The speed of the impeller could be varied from 1400 to 3470 rpm.

It was desirable to know the velocity of the soil particles leaving the impeller so equation [1] was derived neglecting air resistance. See derivation of equation [1] at bottom of the next page.

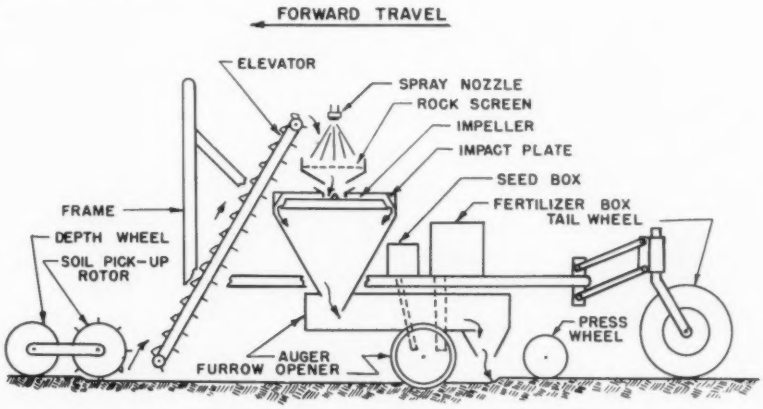


Fig. 3 Schematic diagram of soil processing machine

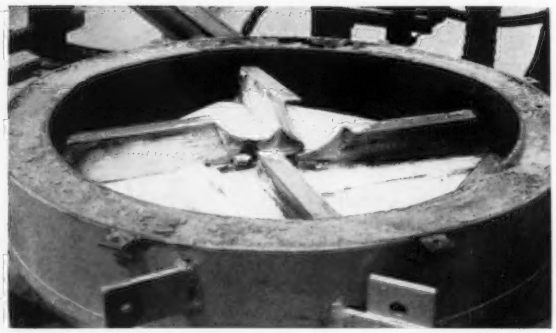


Fig. 4 Impeller and impact plate used on soil processing machine with cover removed

Test Procedure and Results

The machine was initially tested by hand feeding the soil into the field model centrifugal machine. The soil was replaced manually into greenhouse plots of 100 sq-in area. The variables were depth of processing from zero to 2 in and impeller speed from zero to 3470 rpm.

The greenhouse tests on muck soil using no chemical additives indicated that depth of processing was not significant but that impeller speed was highly significant. Table 3 shows this data.

TABLE 3. EFFECT OF IMPELLER SPEED UPON NUMBER OF WEEDS IN PROCESSED MUCK SOIL. (SOIL HAND FED INTO MACHINE)

Impeller speed, rpm	Total weeds per 100 sq in
Zero (check)	100
1400	69
1870	67
2600	135
3470	215

The only explanation for the odd results is that at the lower speeds there may have been some damage to those seeds just ready to germinate, while at high speeds there may have been a scarifying effect on the hard-coated, dormant seeds which caused them to grow and more than offset the partial control obtained at low speeds.

Derivation of equation [1]

$$M\frac{d^2r}{dt^2}=M\,r\,\omega^2-2\,\mu\,\omega\,M\frac{dr}{dt} \quad \ldots\ldots\ldots \quad [1]$$

where ω = angular velocity in radians per second
r = distance from center of impeller at time t
μ = coefficient of friction of soil on steel(7)

The solution is

$$r=\left[r_o-r_oA/(A-B)\right]e^{\omega At}+\left[r_oA/(A-B)\right]e^{\omega Bt}$$

and $$\frac{dr}{dt}=-\omega A\left[r_o-r_oA/(A-B)\right]e^{-\omega At}$$
$$-\omega B\left[r_oA/(A-B)\right]e^{-\omega Bt}$$

where $A=\mu+\sqrt{\mu^2+1}$ and $B=\mu-\sqrt{\mu^2+1}$

It can be shown that the first term does not affect slide rule accuracy so for the conditions of this problem the solution becomes

$$V_r=\frac{dr}{dt}=r\,\omega(\sqrt{\mu^2+1}-\mu)$$

For example: When $\omega=272$ radians per second (2600 rpm), $\mu=0.4$, and $r=10$ in, then the radial velocity is 1840 in per second and the total velocity is 3270 in per second or 186 mph.

No significant weed control was obtained in the 1953 field tests either on muck or mineral soil.

It was anticipated that mechanical processing of the soil would damage its structure and thereby cause increased crusting of the soil. Therefore one of the treatments included the soil conditioner Krilium 9 at the rate of 0.1 percent by weight of the soil processed. A summary of the 1953 results is shown in Table 4. The soil was processed ¾ in deep.

TABLE 4. RESULTS OF 1953 FIELD TESTS TO DETERMINE EFFECT OF KRILIUM 9 ON EMERGENCE OF SUGAR BEETS PLANTED IN MECHANICALLY PROCESSED SOIL

Treatment	Emergence of sugar beets, plants per 100 inches
Check	78
Impeller speed 2600 rpm; no Krilium	57
Impeller speed 2600 rpm; Krilium 9	96

The results of this test were surprising. It was expected that mechanical processing would depress emergence if much rain fell after planting (which did happen), but it was not anticipated that Krilium with the processing would increase emergence over the check plots. The difference between the processed soil with Krilium and the processed soil without Krilium was statistically significant at the 99 percent confidence level. The machine is an excellent device for mixing Krilium with the soil.

1954 Field Tests

Because the attempt to control weeds in the field in 1953 with the mechanical soil processing machine was not successful, it was decided in 1954 to use herbicides in combination with mechanical processing. The variables were:

- Two soils (Brookston clay loam and muck)
- Five herbicides (CMU, CIPC, TCA, Dalapon, Endothal)
- Three herbicide rates
- Two impeller speeds (1780 & 2600 rpm)
- Three Krilium rates (18, 36 & 72 lb per acre of Krilium 212)
- Two crops (sugar beets and onions)

The weather conditions were opposite to those the preceding year. That is no rain fell immediately after planting, but in spite of the lack of rain there was an excellent weed growth which gave a good opportunity to determine the effectiveness of the mechanical soil treatment for weed control.

The results of all the 1954 field tests were negative. Because of a lack of rain, no crusting occurred and therefore the soil conditioner treatment was of no value. There was no significant difference in the weed control between the check plot and the mechanical treatment. The combination of mechanical treatment with herbicides in most cases resulted in significant weed control compared to the check plot, but the combinations were no better than the herbicides alone.

Conclusions

When mustard seed was allowed to soak for about 40 hr it was possible to reduce the germination to zero by mechanically processing the soil in which the seed was mixed.

In the greenhouse tests the number of weed seeds germinating was significantly reduced when the soil was treated

(Continued on page 554)

INSTRUMENT NEWS

KARL NORRIS, *Editor*

Sponsored by the ASAE Committee on Instrumentation and Controls. Contributions on agricultural applications of instruments and controls and related problems are invited, and should be submitted direct to Karl H. Norris, South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md.

Soil Penetrometer Employs Strain Gages

R. J. Hanks and K. A. Harkness
Assoc. Member ASAE

SOIL penetrometers, used by scientists for many purposes (1)*, were used recently to measure soil-crust strength in connection with an investigation of wheat-seedling emergence.

A penetrometer with a probe about the size of a wheat seedling was selected. Preliminary trials indicated that the penetrating force involved with such a probe ranged up to about 4 lb. These trials further indicated that the friction of mechanical devices similar to those used by other workers caused large relative errors in this force range. It was necessary to utilize some method to determine the force that minimized friction. Use of an electrical measuring circuit involving SR-4 strain gages proved to be effective. Several publications (2, 3, 4, 5, 6, 8) aided in the design and construction of the apparatus.

Fig. 1 is a schematic of the penetrometer force-detecting components. When the probe comes in contact with the soil, the resulting force of the soil is reflected by an accompanying strain of the beam supporting the probe. The extent of this strain is indicated electrically as a current by means of strain gages bonded to the beam. The linear relationship of strain (as reflected by an electric current) to applied force was determined by calibration with known forces. This is shown in Fig. 2. Figs. 3 and 4 are photographs of the apparatus. The penetrometer is lowered into the soil by the hand-operated crank or by a constant-speed drive. The force

Paper prepared expressly for AGRICULTURAL ENGINEERING. Contribution No. 536, department of agronomy, Kansas Agricultural Experiment Station, Manhattan. Based on work done cooperatively by the western section, Soil and Water Conservation Research Branch, (ARS), U.S. Department of Agriculture, Kansas Agricultural Experiment Station, and Engineering Experiment Station, Kansas State College.

The authors—R. J. HANKS and K. A. HARKNESS—are, respectively, soil scientist, (SWCRB, ARS), U.S. Department of Agriculture, and former research engineer, Engineering Experiment Station, Kansas State College.

*Numbers in parentheses refer to the appended references.

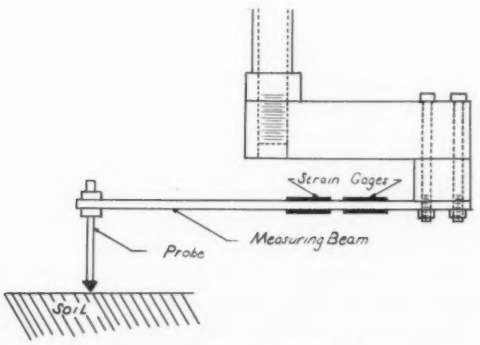


Fig. 1 Schematic diagram of soil penetrometer

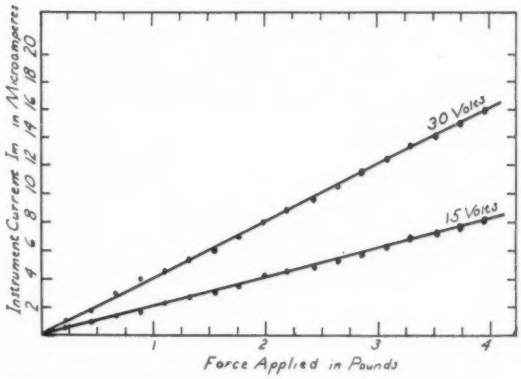


Fig. 2 Relationship of strain (as reflected by instrument current) to applied force at two different voltages across Wheatstone bridge circuit

required to push the penetrometer into the soil, at any instant, can be determined by simply reading the microammeter. A suitable recorder can be used in place of the microammeter to further simplify the operating procedure. Force measurements of varying ranges could be accomplished by changing the dimensions of the beam upon which the strain gages are attached.†

A diagram of the electric circuit is shown in Fig. 5. Four, SR-4, type C-7, 500-ohm strain gages were used. The use of four gages allowed for automatic temperature compensation. The circuit is energized by switching "on" battery E. With no force on the probe, the Wheatstone bridge is balanced by adjusting balancing resistors 50 R_a (coarse adjustment) and R_b (fine adjustment), until the indicating or recording instrument reads zero. Then, to standardize the circuit voltage, the calibrating resistor, R_c, is switched into the circuit. This creates a predetermined unbalance of the Wheatstone bridge and simulates a known force applied to the probe. By adjusting standardizing resistor, R_s, this sim-

†For a beam secured at one end the relationship between strain and dimensions of the beam is $S=6\,FL/MT^2W$, where S is strain, F is the force applied, L is the length of the beam between the point of application of force and support, M is the modulus of elasticity of the material of which the beam is made, T is the thickness of the beam, and W is the width of the beam.

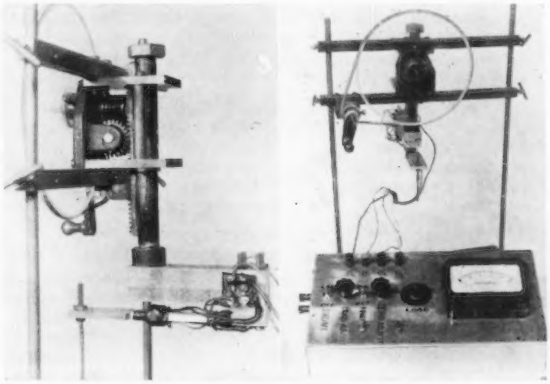


Fig. 3 *(Left)* Mechanism for moving the penetrometer vertically • Fig. 4 *(Right)* Penetrometer and electrical measuring apparatus. The penetrometer can be moved vertically with the hand crank or by attaching a flexible shaft from a constant speed drive

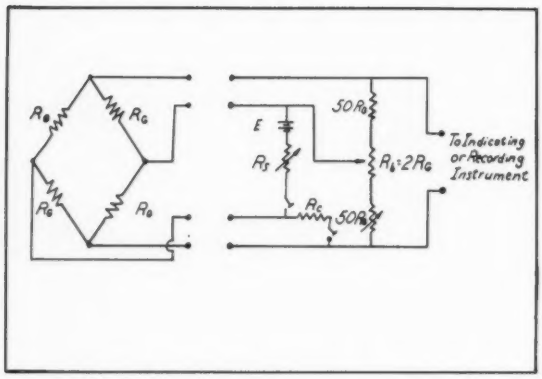


Fig. 5 Strain gage circuit. R_g is the resistance of a strain gage, R_s is a standardizing resistor, R_c is a calibrating resistor, and R_b is a balancing resistor.

ulated force can be placed at any desired point on the scale of the indicating or recording instrument. The magnitude of R_c is usually chosen to simulate a strain equivalent to one-half of the total range of strain measured.‡ Most indicating or recording instruments suitable for use with a Wheatstone bridge can be employed in this circuit.§

With a slight modification, the penetrometer has been used successfully to measure the modulus of rupture of soil (an index of soil crusting) by the method an apparatus of Richards (7). The modification consists of replacing the penetrometer probe with a rod which has been bored to fit over the ⅜-in steel ball of the sample breaking machine. The force to which the briquet is subjected is thus transferred to the measuring beam and indicated with the same apparatus as described above.

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‡For simulated strain equivalent to one-half total range of strain measured (for the circuit of Fig. 4) the value of R_c is where $R_g =$ strain-gage resistance, S_m is the maximum strain to be measured, and G is the gage factor of strain gages.

§The current passing through an indicating or recording instrument is given by (for the circuit of Fig. 4) $I_m = E_b\, SG/R_g + R_m$, where I_m is meter current, E_b is the voltage across the Wheatstone bridge, S is strain G is gage factor, R_g is the strain-gage resistance and R_m is the meter resistance.

Weed Control in the Row

(Continued from page 552)

at low impeller speeds and significantly increased when the soil was treated at high impeller speeds.

The centrifugal machine by mechanical treatment alone did not significantly reduce the number of weed seeds germinating in the two year tests on muck and mineral soil in the field.

When herbicides were used in combination with mechanical treatments the weed control was no better than that obtained with herbicides alone.

A significant increase in the emergence of sugar beets was obtained in the 1953 field tests when the mechanically processed soil was mixed with 0.1 percent of Krilium 9. Considerable soil crusting occurred on these plots following heavy rainfall.

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Engineering Enrollment Up

ENROLLMENT in college engineering has increased for the fourth consecutive year—after successive annual declines from a post-World War II high of 244,390 in the fall of 1947 to a post-World War II low of 147,694 in the fall of 1951, according to a report in the *Journal of Engineering Education*, February, 1956, by W. A. Jaracz and H. H. Armsby.

There were 211,923 engineering students enrolled in schools accredited by the Engineers' Council for Professional Development in 1955, an increase of 13.1 percent over the number enrolled in such schools in 1954. This constitutes a considerable increase—larger, in fact, than that experienced by higher educational institutions in general. Total enrollment in all institutions of higher education increased 8.8 percent, and male enrollment, 11.4 percent. The 1955 increase of 13.1 percent continues the trend in the direction of an annual increase in the rate of increase in engineering enrollment. The 1954 enrollment exceeded that of 1953 by 9.1 percent; the percentage increases in 1953 and 1952 were 8.4 and 7.3, respectively. Engineering enrollment (at all levels) increased by about one-third (33.7 percent) from 1952 to 1955.

TECHNICAL PAPER ABSTRACTS

Following are brief reviews of papers presented at ASAE meetings. Information concerning complete copies of these papers may be obtained by writing to the American Society of Agricultural Engineers, St. Joseph, Mich.

Research Findings on Jet Blast Erosion Along Airfield Runways, by R. G. Nevins and K. L. Anderson, respectively associate professor of mechanical engineering, and professor of agronomy, Kansas State College, Manhattan. Presented at annual meeting of ASAE at Roanoke, Va., June 1956, on a program arranged by the Soil and Water Division. Paper No. **56-9.**

Problems concerning erosion caused by the exhaust from jet aircraft in areas along side runways and taxiways are discussed in this article. Heavy erosion at values of surface drag greater than 3 lb per sq ft have been found.

Model tests with small solid barriers (one-half of the diameter of the jet outlet) showed that erosion could be reduced and possibly eliminated. A vertical air jet barrier emanating from a long slit perpendicular to the jet blast was found to be useful in reducing the erosive action of a model jet blast.

Flats of bermudagrass subjected to blasts of heated air were found to be severely damaged at velocities of 78 mph and temperatures of 180 F and above. Exposure of 10 seconds duration, every minute for 10 minutes killed the aboveground foliage at 180 F and at 220 F limited the regrowth, indicating some damage below the soil surface. The dried foliage continued to provide cover and prevented erosion for some time. Spraying the foliage with water prior to the air blast had a significant effect on reducing the amount of damage to the grass. The height of the grass and the soil moisture content had no appreciable effect on the results.

The possibility of erosion control with grass alone seems limited to areas within 85 to 100 ft of the runways, it is reported.

•

Special Vegetation for Earth Covered Structures in the Semiarid Areas, by Edward H. Doll, Soil Conservation Service, USDA, Lincoln, Nebr. Presented at annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Soil and Water Division. Paper No. **56-10.**

Protection against wind and water erosion on storage magazines at the U. S. Naval ammunition depot near Hastings, Nebr., is discussed. Trial plantings of grasses and drought tolerant shrubs were made on the top as well as south and west slopes. A mulch was applied to the broadcast seeding which was raked in by hand. The season of 1955 was unusually droughty.

Spike muhly is reported to have the greatest possibility of all the grasses. After a dry winter, black grama, southern strains of blue grama and sideoats grama are also making spring growth.

The drought of 1955 was too severe for any of the woody species to come through the first season of growth. Woody species were replanted in 1956. Sodar wheatgrass, planted November 29, 1955, had emerged by May 10, 1956. Matrimony vine and crown vetch were added to the planting in spring of 1956. These will also be observed in arriving at a solution to the problem.

Electrostatic Seed Separation, by Dean E. Booster, graduate research assistant, Oregon State College, Corvallis. Presented at annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Power and Machinery Division. Paper No. **56-11.**

Electrostatic separation of crop seeds based upon differences in the electrical properties of the seeds to be separated is covered in this paper. The electrical properties most commonly utilized are electrical conductivity, contact potential, and dielectric constant. This is in contrast to conventional separation processes which are usually based upon differences in size, shape, weight or surface texture of the seeds to be separated. In the electrostatic separator, seeds are given a surface charge of electricity by being exposed to a high-voltage electrode.

According to the paper, changes in seed moisture content affect the rate at which seeds are able to dissipate an electric charge. Two or three percent change in the moisture content is often enough to impair the separations of some seed mixtures.

The author reports that electrostatic separation is, at present, receiving limited use in the seed cleaning industry, but with further research, he states that expanded use is possible. Electrostatic separation makes possible separations that are impracticable or impossible with conventional seed cleaning equipment. Investigations were made of seeds exposed to voltages up to 25,000 volts. It is reported that no detectable differences in the germination of exposed and unexposed seed samples could be observed.

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Time and Energy Analysis of Agricultural Tasks, by W. E. Splinter and C. W. Suggs, associate professors of research, North Carolina State College, Raleigh. Presented at annual meeting of ASAE in Roanoke, Va., June, 1956, on a program arranged by the Power and Machinery Division. Paper No. **56-17.**

A method of recording the heart rate for determining the expenditure of energy in performing agricultural tasks is presented in this paper. The authors point out that time and motion studies may indicate that a task can be carried out more quickly by one method as opposed to an alternate method, but such studies do not allow the conclusion that either method is easier or less fatiguing.

The paper reports that the increase in heart rate over its resting rate has been found to be linear with increasing effort within the limits of extreme energy output, recognizing that the resting rate varies between individuals as well as from day to day for any one subject. Accordingly instrumentation was developed by which the heart rate of an individual could be recorded prior to, during, and after a task was performed.

Results of studies carried out on the "priming" of ripe tobacco leaves from the stalk and on the transplanting operation indicate that although certain methods or procedures gave nominal increases in unit output the energy studies indicated considerable differences in the effort required for various tasks.

The Effect of Controlled Temperature on the Quality of Chicken Eggs, by Clayton C. Brunson, C. W. Pope and A. B. Watts, Poultry Industry Department, Louisiana Agricultural Experiment Station, Baton Rouge. Presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a joint program of the Farm Structures and Rural Electric Divisions. Paper No. **56-13.**

Influenced by the fact that egg shell quality and the interior quality of eggs decrease during the summer months, an investigation was conducted to determine to what extent these decreases are influenced by warm weather and by length of time in production. A preliminary investigation was made using two pullets that came into production at different seasons (November 1 and June 1). During one week of each month of the first nine months of production, egg specific gravity (a measure of shell quality), egg shell weight and the interior quality (as measured by Haugh units) were determined for all eggs laid.

Egg specific gravity and shell weight expressed as a percentage of the total egg weight were found to be lowest during the summer and early fall months when the environmental temperature was above an average high of 70 F. However, the interior egg quality of each group decreased throughout the experiment indicating that length of time in production and more influence on interior quality than season of the year.

In the second phase of this experiment, one group of pullets was housed in a conventional-type laying house and another group was housed in a room in which the temperature was controlled to 70 F. Egg quality measurements were made during the fourth through the ninth months of production (March through July).

Egg quality measurements in these two groups of pullets showed the same trend. However, eggs laid by pullets housed in the controlled-temperature room were higher in all measurements during the hotter months than eggs laid by pullets which were exposed to fluctuating environmental temperatures.

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Developing Water Rights Legislation in Georgia, by Cecil W. Chapman, state conservationist, SCS, USDA, Athens, Ga. Presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by Soil and Water Division. Paper No. **56-15.**

This paper is designed to tell the story of the manner in which people working together within a state have recognized and are dealing with the problem of needed additional water rights legislation. Although an increasingly greater use of water has been taking place and competition and some conflicts have developed, the droughts of 1953 and 1954 focused the attention of the citizens on water problems, particularly the question of whether the water laws adequately encouraged the development of wise use, conservation and protection of water resources in the state.

About two years ago a citizens committee, which came to be known as the Georgia Water Use and Conservation Committee, was formed to facilitate a joint study of water problems and laws. The four major water-using groups, agriculture, industry, municipal and recreation, were included in this citizens committee.

The work of this committee was responsible for the creation of a state water

law revision commission, which is now studying the water resources of the state, water laws of the state, and are making recommendations to the Georgia general assembly.

The paper deals in some detail with a step-by-step procedure which has been successfully followed in dealing with a problem in the matter of establishment of policy with respect to water. It points up the necessity for a broad educational program, and the necessity for providing a forum through which the many facets of such a problem can be completely aired with a view toward accomplishing an end result which will be in the interest of the greatest number of people.

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A Teaching Program in Agricultural Processing, by G. W. Isaacs, assistant professor of agricultural engineering, Purdue University, West Lafayette, Ind. Presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by Education and Research Division. Paper No. **56-16.**

Topical outlines of proposed courses in agricultural processing for agricultural engineering students and other agricultural curricula are presented in this paper. The author explains that increased instruction in agricultural processing subject matter is being considered by many agricultural engineering departments. A unit operations type of course covering the basic operations in processing agricultural products is presented as a desirable required course for senior agricultural engineers. Ten universities in the United States reportedly are offering such a course. A more advanced unit operations course with greater emphasis on off-the-farm processing is suggested to be considered subsequently.

Other courses suggested by the author include: *(a)* a general survey course in on-the-farm processing, containing a large element of crop drying and conditioning; *(b)* additional service courses, as needed, in dairy mechanics and food machinery for other agricultural students in dairy manufacturing and food technology; and *(c)* agricultural short courses on selected topics as local need demands.

•

Physiology of Livestock in Hot Humid Climates, by Douglas H. K. Lee, chief, research branch, Office of Quartermaster General; (formerly professor of physiological climatology, Johns Hopkins University). Presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Farm Structures Division. Paper No. **56-19.**

This paper gives an account of studies carried out over the last twenty years, first in Australia, and later in the United States. Most of the work concerns the effect of single short exposures to heat.

Thermo-regulatory reactions in domestic animals are discussed with the conclusion that it is probable that those animals within a species which show relatively greater tolerance to heat owe this superiority to a lower rate of heat production. If performance is maintained at the same level, this means a relatively greater efficiency in metabolic energy transformations. It is suggested that the search for more heat-tolerant animals should concentrate on detecting such better energetic efficiency.

The author states that the adjustments made by an animal in attempting to preserve its heat loss may bring about other disturbances in the bodily economy. To the extent that the animal fails to maintain its heat balance, various functions are affected—appetite, rumination, intestinal function, fertility, and nervous function.

The effect of repeated exposures was found to depend upon the length of the interval between and the conditions to which the animals are exposed in the interval. Under naturally fluctuating summer conditions, a fall in milk production was correlated with hot conditions on the fourth and fifth days before milking. The author suggests that an index relating environmental conditions to animal productivity and welfare is badly needed.

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Electricity versus Bottled Gas for Commercial Broiler Production, by Olin W. Ginn, division rural engineer, Georgia Power Co., Athens. Paper presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Rural Electric Division. Paper No. **56-14.**

The development and history to date of the electric hover-type brooder for use in broiler production in Georgia, are discussed in this paper. The load and revenue possibilities for the electric industry, as well as low cost brooding made possible by use of off-peak current, are emphasized. The author presents reasons why electric brooding has not been used more widely in the past. Not only does he explain how the electric hover-type brooder overcomes these objectional disadvantages, but he lists additional features that favor its use.

The article suggests, however, that the success of the electric hover-type brooder depends upon adequate wiring, a good quality brooder at a reasonable price and dependable low cost electricity.

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A Balanced Forage Crop Program, by R. E. Blaser, department of agronomy, Virginia Polytechnic Institute, Blacksburg. Presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the National Joint Committee on Grassland Farming. Paper No. **56-12.**

A balanced forage crop program described in this paper is a 12-month feed program where fields are seeded to different mixtures and used for grazing, hay, silage, chopped green feed or combinations of these practices. Because more than one-half of the yield of perennial grasses and legumes is produced during the spring season, the plan calls for more mixtures and land to be used for summer and fall grazing than for spring grazing. Some of the fields or mixtures that are not grazed during the favorable moisture season in spring may be harvested once or twice for silage or hay and then grazed in rotation with other fields during the drier summer season.

The author reports that the development of such a balanced program depends on the use of well adapted varieties and mixtures, adequate liming fertilization and on cutting and grazing management practices that encourage high yields and herbage quality along with a long productive life.

An experiment conducted at the Northern Virginia Pasture Research Station showed an increase of 81 percent in carrying capacity for a management scheme where five fields were used flexibly in a 12-month feed program for silage, hay and grazing as compared with one mixture that was grazed continuously. The fertility practices and soil conditions for the two systems of management were similar.

Water Yield Prediction Based on Watershed Characteristics, by Paul R. Nixon and Glenn O. Schwab, respectively, associate agricultural engineer and professor of agricultural engineering, Iowa State College, Ames. Presented at the annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Soil and Water Division. Paper No. **56-18.**

Development of a simple rational approach for estimating the water yield of a watershed is explained in this paper. The watershed rating obtained by this method is dependent upon measurement and observation of five physical characteristics—climate, land use, land slope, soil, and management and conservation practices. Factors used in determining watershed rating were assigned to these physical characteristics on the basis of experimental data and general observations. The necessity of restricting a given set of factors to a single physiographic region is recognized. A comparison was made, for each of five Iowa watersheds, of water yield estimated from physical characteristics with the measured yield. The estimated median yield from watersheds 525 to 9,850 acres was within about 12 percent of the measured median yield. The usefulness of the method as a means of predicting yield from small ungaged watersheds is indicated by the close agreement.

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Erosion Control on Earth-Covered Magazines and Barricades in Arid and Semi-Arid Areas, H. E. Dekker, soil conservation and erosion control, District Pulblic Works Office, Twelfth Naval District, San Bruno, Calif. Presented at annual meeting of ASAE at Roanoke, Va., June, 1956, on a program arranged by the Soil and Water Division. Paper No. **56-20.**

Methods employed for erosion control at three locations where rainfall is less than 15 in per year are explained in this paper. In the semi-arid valleys of California, where the average annual rainfall measures from 12 to 15 in, a few select annual grasses will reseed into fairly solid stands and provide erosion control on magazine slopes.

In Nevada, however, at elevations of from 4000 to 5000 ft, subject to great temperature variations and low humidity, and where annual precipitation runs from 9 to 14 in, annual reseeding is required and is not always successful.

In truly arid country, such as that in which the Naval Ammunition Depot at Hawthorne, Nev. is located, climatic conditions preclude the growing of grass without irrigation. The normal annual rainfall averages 3½ in, relative humidity drops to 15 percent in summer, the elevation is 4200 ft. It is a region of dry, cold winters and hot summers, visited periodically by violent cloudbursts and equally violent windstorms.

Some 2000 earth mounds over magazines were protected against erosion by the application of hot, liquid asphalt. Oxidation of the asphalt, followed by its separation and the subsequent invasion of tumbleweeds and rodents caused continuous erosion by water and wind. Maintenance of the asphalt covers, consisting of weedpulling, gully repair and reapplication of asphalt, is estimated at $75.00 annually per magazine.

Tests with gravel covers, initiated in 1948 and continued in 1952, were so successful that all magazines and barricades constructed since then have had gravel applied to them instead of asphalt. Weeds are virtually nonexistent, rodents are discouraged by the loose gravel and no erosion has taken place.

NEWS SECTION

Nominations for 1957 ASAE Gold Medal Awards

IN ACCORD with the rules governing the award of the John Deere and Cyrus Hall McCormick Gold Medals, the Jury of Awards of the American Society of Agricultural Engineers will receive from members of the Society, up to November 1, nominations of candidates for the 1957 awards of these two medals.

The Jury of Awards desires that members of the Society consider it their duty and obligation to give serious thought to the matter and nominate for either or each of these awards the men they believe to be most worthy of the honor. Each nomination must be accompanied by a statement of the reason for nominating a candidate and qualifications of the nominee, including his training, experience, contributions to the field of agriculture, a bibliography of his published writings, and any further information which might be useful to the Jury in its deliberations.

The Jury will consider nominations received on or before November 1, and these nominations should be addressed directly to the Secretary of the Society at St. Joseph, Michigan. The Secretary will supply on request a standard set of instructions for preparing information in support of nominees for the Society's gold medal awards; in fact, it is important that these instructions be followed in preparing material on behalf of any nominee.

Second Nuclear Engineering and Science Congress

THE Second EJC Nuclear Engineering and Science Congress and accompanying Atomic Exposition will be held March 11 to 15, 1957, in Philadelphia, Pa. Like the first congress, which was held in December, 1955, Cleveland, Ohio, the event will be coordinated by Engineers Joint Council. Both the technical sessions and the over-all congress meetings, as well as the exposition, will be held in the Convention Hall

Nineteen major engineering and scientific societies (which includes ASAE) already have indicated their participation in the congress. An even larger group of engineers and scientists from industry, business, education and government, than the nearly 3,000 who attended the first meeting, is expected. It is also expected that the atomic exposition, which will display the latest developments in the application of nuclear energy, will draw a greater audience than the 13,000 who saw the Cleveland exhibits.

ASAE Meetings Calendar

August 28-30—NORTH ATLANTIC SECTION, Riley-Robb Hall, Cornell University, Ithaca, N. Y.

October 24-26 — PACIFIC NORTHWEST SECTION, Penticton, British Columbia

December 9 to 12 — WINTER MEETING, Edgewater Beach Hotel, Chicago

February 4-6 — SOUTHEAST SECTION, Birmingham, Ala.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

New Officers of National Council of ASAE Student Branches

MEMBERS of the Student Branches of the American Society of Agricultural Engineers assembled at the Society's 49th Annual Meeting at Roanoke, Va. in June, elected the following new officers of the Council for the 1956-57 year:

President — Joseph Long, University of Georgia

1st Vice-President—Ronald Sneed, North Carolina State College

2nd Vice-President—Harold Sattler, A. & M. College of Texas

Secretary—Ewart Brundrett, Ontario Agricultural College

These officers were installed following their election on June 20.

Student Paper Award Winners

DANIEL A. VANDUYNE, Pennsylvania State University, was named first place winner in the student paper awards contest at the annual meeting of the American Society of Agricultural Engineers.

Second place in the contest went to George J. Schurr, Kansas State College, and third place to Billie L. Harriott, Iowa State College.

The winning paper was presented as a feature of the general session immediately following the presidential address. Subject of the paper was "Automatic Feed Processing from Penn State."

The second place paper by George J. Schurr was entitled "Strain Gage Measurements of Draft of Two Subsoiling Chisels," while Billie Harriott's subject was "Comparison of Five Types of Forage Harvesters."

Each of the three top national winners were previously selected by the ASAE Committee on Student Paper Awards from among papers submitted from student branches all over the country.

Winner of the student paper awards contest, Daniel A. VanDuyne, Pennsylvania State University, presents his paper, "Automatic Feed Processing from Penn State," before the general meeting of ASAE during the 1956 annual meeting

(Left) Trophies presented by the Farm Equipment Institute to ASAE Student Branches at the 1956 ASAE annual meeting at Roanoke, Va., were displayed by representatives from the winning student branches. *(Left to right)* R. H. Driftmier, chairman, agricultural engineering dept., University of Georgia; Joseph Long, student, University of Georgia; D. F. Turner, chairman of the FEI Award Committee; Fred Kiser, student, North Carolina State College; and Henry D. Bowen, faculty advisor, North Carolina State College. The Georgia Student Branch was the Group A winner and the North Carolina Student Branch was the Group B winner • *(Right)* Newly elected officers of the National Council of ASAE Student Branches, at the 1956 ASAE annual meeting. *(Left to right)* Joseph Long, University of Georgia, president; Ronald Sneed, North Carolina State College, 1st vice-president; Harold Sattler, A. & M. College of Texas, 2nd vice-president, and Ewart Brundrett, Ontario Agricultural College, secretary

Blue Ribbon Awards for Annual Meeting Exhibits

ANNOUNCEMENT of extension exhibit blue ribbon winners at the 1956 ASAE Annual Meeting has been made by F. W. Andrew, vice-chairman, Committee on Extension. Displays were provided by industrial and public service organizations all over the country.

Exhibits were displayed and judged according to type and class of entry. Classes included motion pictures, publications (bulletins and periodicals), slides and film strips, demonstration models, new textbooks, and extension methods. There were no entries in the radio and television class.

Movie awards under the direction of B. Parker Hess, were won by two films in the industrial group and two in the public agency group. The industrial winners were "When Steam Was King," by J. I. Case Co., entered by L. G. Samsel; and "Dan Taber's Ledger," by American Steel & Wire Division of U.S. Steel Corp., entered by Paul G. Strom. The public agency winners were "The Wisconsin Electric Research Farm" produced by the University of Wisconsin Extension Division in cooperation with the Wisconsin Utilities Association, and "Barns for Better Dairying" by University of Wisconsin Agricultural Experiment Station in cooperation with the U.S. Steel Corp. Both films are available through the Bureau of Audio Visual Instruction, 1312 W. Johnson St., Madison, Wis.

Slide and film strip entries were in charge of E. A. Olson. Winners in the public agency group were "How Electric Motors Start and Run" by Southern Association of Agricultural Engineering and Vocational Agriculture, University of Georgia, Athens; and "Self Feeding Hay Finisher" by Iowa State College, Ames. Winners in the industrial group were "Bulk Handling of Milk" by Public Service Div. of Commonwealth Edison Co., West Chicago, Ill.; and "Materials Handling—Newest Farm Science" by *Successful Farming,* Des Moines.

Publications were in charge of D. W. Derber and were divided into industrial and public agency classes. The industrial winners included "Materials Handling—Newest Farm Science," *Successful Farming;* "Gulf Farm Tractor Guide," by Gulf Oil Corporation; and "Farm Progress—Midwest Edition," by Massey-Harris-Ferguson, Inc.

The public agency bulletin and periodical winners included "Planning Farm Water Systems" by Southern Association of Agricultural Engineering and Vocational Agriculture, University of Georgia; "Agricultural Engineering Information Leaflet" by agricultural engineering department, University of Illinois; "Equipment for Handling Beef Cattle" by Colorado A & M College; and "Contemporary Farm Houses," agricultural engineering department, University of Illinois.

Entries in the demonstration models, under the direction of S. P. Lyle, received a great deal of visitor attention. A sow separate swine production system by the Reynolds Farm Institute, Louisville, Ky., and a scale model, pole-type poultry house constructed of all-purpose farm board by Masonite Corp., Chicago, were winners in the industrial class. In the public agency group of demonstration models, line brace and end brace demonstration by the Virginia Polytechnic Institute, Blacksburg; wiring demonstration cabinet by Illinois Farm Electrification Council, University of Illinois, Urbana; and a hood inlet for closed conduit inlets by Agricultural Research Service, USDA, Minneapolis, Minn., were winners.

Among the extension method outlines exhibited under the direction of R. L. Ricketts, winners were Delbert M. Byg, extension agricultural engineer, Ohio State University; J. T. Gaillard, farm mechanization specialist, Alabama Polytechnic Institute, Auburn; Edwin S. Coates, extension agricultural engineer, North Carolina State of Agriculture, Raleigh; and Houston D. Luttrell, assistant extension agricultural engineer, University of Tennessee, Knoxville.

Several textbooks were entered in that section of the exhibit under the direct of J. P. Schaenzer. Due to the wide range of subject matter and the time required to make a fair comparison of these works, no awards were made in this class.

President Bainer on North Atlantic Section Program

ROY BAINER, ASAE president, will present the introductory speech at a meeting of North Atlantic Section of the American Society of Agricultural Engineers to be held August 28, 29 and 30 at the new agricultural engineering building (Riley-Robb Hall), Cornell University, Ithaca, N. Y.

The first half day will consist of a general program, in which a welcome address will be presented by D. W. Malott, president, Cornell University; a report on the 1953 Hoover Commission by S. C. Hollister, dean, College of Engineering, Cornell University, and a talk on agricultural water resources by E. A. Norton, SCS, Northeastern States Division, USDA.

In the afternoon of the first day, August 28, three concurrent sessions will be held, consisting of a Power and Machinery program, a Soil and Water program and a Joint Farm Structures and Rural Electric program. Many interesting papers appear on the program. Topics cover animal shelter ventilation, air conditioning for poultry houses, controlled atmosphere apple storage, mechanical potato harvesting and bulk handling, silage movements through a blower, custom built rubber products for agriculture, recent developments in fuels and lubricants, hydrologic studies of floods in upstream watersheds, selection of a flood frequency method, estimating annual irrigation water requirements, and consumptive use of water by vegetable crops. A chicken barbecue will be held Tuesday evening.

The second day of the meeting will be devoted to concurrent sessions of the four technical divisions. Such subjects as new trends in tractor tires, new developments in bearings for farm machinery, fundamentals of radio isotopes, the use of radioactive tracers in fertilizer placement, application of asphalt roofing products to low sloped roofs, an all plywood poultry house, the economic aspects of aluminum roofing sheet, report of Northeast technical committee on poultry housing, drainage problems in New York, land forming and smoothing for more efficient production, a heated septic tank for the disposal of dead chickens, experiences in crop drying, soil heating with electric cable, betterment of farm wiring, and a symposium on soil compaction and proposed remedial measures including tillage, are covered during the morning sessions.

Optional tours and recreation are planned for Wednesday afternoon.

The Engineer in Today's Dairy Farming is the theme for the general session, from 9:00 a.m. to 3:00 p.m. August 30. Papers presented during the session include: Management Engineering in Agriculture with Special Reference to Dairy Farming, by H. E. Pinches; Evolution in Dairy Farming in the Northeast, by J. W. Stiles; Developments in Zero Pasture and Mechanical Grazing, by Edward A. Silver; Portable Electric Fences and Controlled Grazing, by Lowell E. Campbell; Development of Mechanical Metering Equipment for Unloading Silage from Wagons or Trucks, by Nathan Rich; Uniform Standards for Milk Houses, by John W. Layer; Automatic Ear Corn Grinding and Mixing, by Ralph P. Prince; Hot Water Requirements on Dairy Farms, by L. H. Hammond; and Controlled Operation of Bulk Milk Coolers for Lower Cost Operation, by P. E. Steiger.

M. S. Klinck, chairman of the North Atlantic Section, will preside at a business meeting to be held at 3:45 p.m. The section banquet will be held in Statler Hall at 6:30 p.m., Thursday, August 30.

Dedication of Cotton Ginning Research Laboratory Set

THE Agricultural Research Service of the U.S. Department of Agriculture announces that the dedication of the Southeastern Cotton Ginning Research Laboratory Clemson, S. C., will be held in conjunction with Farm and Home Week at Clemson Agricultural College, August 14.

The dedication day has been named "Cotton Day" and will begin with a program at the research laboratory, located on Cherry Road, at 9:00 a.m. Reports on cotton production practices will be presented by several departments of Clemson Agricultural College. C. P. Butler will represent agricultural economics; T. P. Reid, agricultural engineering; G. R. Craddock, agronomy; W. B. Albert, botany; and J. K. Reed, entomology.

The Honorable Earl L. Butz, assistant secretary, U. S. Department of Agriculture, will present an address at Tillman Hall, Clemson Agricultural College campus, at 12:00 noon. The dedication ceremony will begin at 2:00 p.m. and representatives from experiment stations, extension services, Cotton and Cotton Seed Advisory Committee, National Cotton Council of America, American Cotton Manufacturing Institute, and National Cotton Ginners' Association, are scheduled to present talks.

Tobacco Workers' Conference

THE 1956 Flue-Cured Tobacco Workers' Conference will be held in London, Ontario, Canada, August 27 to 30, according to an announcement by G. W. Giles, head of the department of agricultural engineering at North Carolina State College and general chairman of the conference.

This conference brings together workers in all disciplines for discussion of mutual problems and accomplishments. The conference is subdivided into four sections; namely, agronomy, agricultural engineering, entomology and pathology. The chairman for the agricultural engineering section is McNeill Marshall of Virginia Polytechnic Institute and the vice-chairman is Paul N. Winn, Jr. of the University of Maryland.

An important feature of the conference will be trips to the area of Delhi and Harrow, Ontario, to learn about research work and tobacco production in general. Over one-half of the flue-cured crop in Canada is under irrigation.

G. W. Giles reports that members of ASAE are cordially invited to attend. Group transportation by bus from the Southeast area of United States has been arranged. Program details can be obtained by writing to H. F. Murwin, supt., Experimental Station, Dept. of Agriculture, Harrow, Ontario, Canada, or to G. W. Giles at North Carolina State College.

(News continued on page 582)

(Left) Wayne H. Worthington, retiring president, is about to present the gavel to the new Society president, Roy Bainer, at the annual dinner. Mr. Bainer is chairman, agricultural engineering dept. and assistant dean of engineering, University of California • *(Center)* Walter G. Barlow, vice-president, Opinion Research Corp., delivered the annual dinner address and presented an interesting and informative analysis of the agricultural engineering profession based on an impartial survey • *(Right)* Wayne H. Worthington proudly displays a beautiful hand-tooled cowhide brief case presented to him by ASAE Member Howard Matson at the annual dinner. The design and tooling of these brief cases presented the past ten years to retiring ASAE presidents is a hobby of Mr. Matson

Photo High Lights of

ASAE 49th ANNUAL MEETING

Roanoke, Va.

June 17 to 21

William J. Fisher, vice-president, The Oliver Corp., York, Pa., spoke to students attending the ASAE annual meeting at a luncheon sponsored by the Farm Equipment Institute Agricultural Research Committee. His topic was "Opportunities for Engineers in the Farm Machinery Industry"

The Honorable True D. Morse, Under Secretary of Agriculture *(left)*, is officially welcomed to the annual meeting by Roy Bainer, newly-elected president of ASAE. Secretary Morse addressed the joint meeting of the Power and Machinery Division of ASAE and the National Joint Committee on Grassland Farming, June 20, on the subject "Soil Banks for More Profits"

(Left) The registration desk in the concourse of the Hotel Roanoke was a beehive of activity throughout the entire meeting. Over 1000 members and guests attended the annual meeting • *(Right)* A complete program of activities for ladies and children had been arranged by the local arrangements group of the Virginia Section of ASAE. Shown are some of the ladies who attended the ladies' bridge party held Tuesday afternoon, June 19

Paul C. Mortenson has joined Vickers, Inc., as chief engineer of ground mobile products. In his new capacity, he will be responsible for development, design and test operations of three separate product line sub-groups within the ground mobile product classification. The groups, each of which is under the supervision of an assistant chief engineer, include farm machinery and materials handling; earth moving, heavy trucks and buses; and passenger cars and light trucks.

Mr. Mortenson is a mechanical engineering graduate of the University of Southern California. He has also studied at the University of Wisconsin and Curtiss Wright Technical Institute. From 1940 to 1950 he worked in various engineering capacities for Lockheed Aircraft Corp., North American Aviation Corp. and Young Radiator Co. He joined Massey-Harris-Ferguson, Inc. in 1950 and became administrative engineer, Western hemisphere, for Massey-Harris-Ferguson, the position he held prior to joining Vickers.

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Ralph W. Sohl, chief engineer for the agricultural tire development department of The Goodyear Tire & Rubber Co., has retired following a 37-year association with the company. A draftsman during his early years with the company, Mr. Sohl was named manager of mold development and tire design in 1924. He worked as a manufacturers' contact from 1932 until 1937.

Since 1932, when he was instrumental in putting the first set of pneumatic tires on farm tractors, he has made many important contributions to the development of tires for agricultural purposes. During World War II, he worked closely with the armed forces in the development of combat tires and related products. He was appointed section head in charge of farm tires following the war, and named chief engineer in 1951.

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George H. Larson, professor of agricultural engineering, has been named as head of the agricultural engineering department, Kansas State College, Manhattan.

Mr. Larson was born on a farm near Lindsborg, Kans., January 28, 1915. He attended Bethany College in Lindsborg, Kansas University, and Kansas State College from which he received a B.S. degree in agricultural engineering in 1939 and an M.S. degree in 1940. While studying for his masters degree he served as a graduate research assistant. After graduation he accepted a position as assistant instructor in the agricultural engineering department, University of Wisconsin, and later became an instructor in the Panhandle A&M College, Goodwell, Okla.

June, 1942, he received a civil service commission appointment in the Navy Department where he served 4 years. After his release from the Navy he became an assistant in agricultural engineering, University of Wisconsin, and in September, 1946, he accepted the position of associate professor, agricultural engineering department, Kansas State College, later becoming professor.

In 1953 he was granted a leave of absence from Kansas State College to attend Michigan State University. He received a PhD degree in 1955 having submitted a thesis on methods for evaluating important factors affecting selection and total operating costs of farm machinery. He then returned to Kansas State College and taught courses in the field of farm power.

ASAE MEMBERS in the News

P. C. MORTENSON

R. W. SOHL

G. H. LARSON

T. J. THADEN

Theron J. Thaden has been named chief engineer, agricultural tire development, for The Goodyear Tire & Rubber Co., to succeed R. W. Sohl.

Since 1948, Mr. Thaden served as a designer in the department he now heads. He joined the company in 1946 in a training capacity, and was transferred to mold design as a draftsman later the same year. His move to agricultural tire development followed in 1948. He was graduated from the University of Nebraska in 1946 with a B.S. degree in mechanical engineering.

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Virgil Overholt (ASAE Fellow) retired June 30 from the agricultural engineering department, Ohio State University, after 41 years of service.

He was born in Hancock County, Ohio and taught district school for a year prior to entering Ohio State University in 1910. He graduated in 1915, and on July 1 of the same year joined the OSU staff as the first agricultural engineer extension specialist in Ohio.

In 1917, during World War I, he served in France with the American Expeditionary Force. Returning to Ohio State after 1½ years, he resumed his extension activities. For the past 30 years he has done resident teaching one-fourth time and devoted the rest of his time to extension.

From the outset, his major activity has been drainage, although in the early years his work covered the whole field of agricultural engineering. He has directly influenced the improved drainage of over one million acres of land in the state. He organized a soil erosion control program in Ohio in 1920. In 1933 he helped organize the first erosion control camps, and as early as 1920 designed and supervised the construction of farm ponds in Ohio. In recent years, he has designed upground reservoirs for farm water storage, which can be used in places where conventional ponds are not adaptable.

Mr. Overholt is recognized locally and nationally as an authority on soil and water management, and has served on the Governor's Water Committee, the Farm Water Task Force and drainage standards committees for the Ohio Turnpike and ASAE.

Mr. and Mrs. Overholt plan to remain in Columbus after retirement where he will do private consultant work on a part-time basis. He is keenly interested in history and has one of the finest collections of old drain tile in the country. He plans to devote much of his time to his six grandchildren, and work in some hunting and fishing.

•

Wayne H. MacFarlane, vice-president and director of engineering of Minneapolis-Moline Co., has been named to a new position as vice-president-administration.

William E. Swenson, assistant director of engineering, succeeds Mr. MacFarlane as director of engineering.

Mr. MacFarlane began work in 1935 at the firm's Minneapolis tractor plant after attending Lawrenceville School in New York, and Yale University. After several years in the tool room, foundry, assembly department, engineering laboratory, and superintendent's office he went into the Army in 1943. On his return to the company in 1946, he was named manager of materials and methods. He became manager of the firm's Louisville plant in 1952. In 1954, he was elected vice-president and director of engineering.

Mr. Swenson started with the Minneapolis-Moline Co. in 1926. He served as tracer, draftsman, and designer in automotive engineering until his appointment as design engineer in 1943. He was promoted to assistant chief engineer in 1944 and in 1954 became design correlator for the manufacturing and engineering divisions of the company. He was appointed assistant director of engineering in 1955.

•

James M. Dill, Jr. has been appointed as assistant to vice-president of sales, Russell, Burdsall & Ward Bolt and Nut Co. His new office will be in Port Chester, N. Y. Previously he worked in the company's Chicago sales department. He is a graduate of Yale University and has been with the company since 1946.

•

James T. Ashton has resigned his position as section supervisor, grain harvester engineering, Tractor and Implement Division, Ford Motor Co., to become associated with his son, J. W. Ashton, Oliver-Wagner dealer at Salinas, Calif.

•

Sherman C. Heth left his position of chief engineer, Main Works, J. I. Case Co., and has taken a position as staff engineer, advance engineering, International Harvester Co. in Chicago, Ill.

•

Homer K. Smith has completed requirements for an M.S. degree in agricultural engineering from Purdue University, and is now employed as an engineer-trainee with the John Deere Waterloo Tractor Works.

•

William H. Johnson, received an M.S. degree in agricultural engineering from North Carolina State College, and has accepted a position as research instructor to do research work in improving the quality and reducing the labor involved in tobacco curing. He will be working in a cooperative program with the North Carolina Agricultural Experiment Station and the Farm Electrification Section (AERB), U. S. Department of Agriculture.

"I make $120 a month extra with my bulk milk tank"

SAYS W. G. LEHNING
BOSTON, NEW YORK

Mr. Lehning has kept a good set of records since he installed his Stainless Steel bulk milk tank in October, 1953. First, he earns a 10¢ per cwt. premium from the dairy because of his bulk milk system. His butter fat average is up from 1 to 1½ points—and he gets seven extra cents per point.

But there's more to the story. Since he changed to bulk handling, Mr. Lehning estimates that he saves about 5¢ per cwt. simply because of reduced stickage. He saves about one hour per day of hard labor that he used to spend wrestling with heavy cans, and his bacteria count is *one half* of its previous average (it's now running about 10,000).

Mr. Lehning is currently milking 46 Holsteins; and, with his $120 a month savings, his 400-gallon bulk milk tank will pay for itself in less than three years. After that, the tank earns pure profit.

Why don't you get all the facts about Stainless Steel bulk milk tanks? Just send the coupon.

See The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

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UNITED STATES STEEL

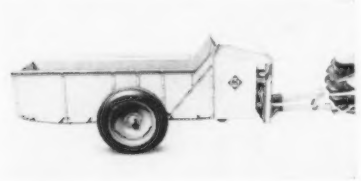
NEW PRODUCTS CATALOGS

Front-End Delivery Manure Spreader

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., enters the manure spreader business with a front-end, enclosed-delivery power take-off operated machine.

This new No. 110 spreader has all the shredding and spreading units in front. All are fully shielded to prevent damage in loading. Three turbine-type spreaders distribute material across a 12-ft width. Spreading action is down and to the sides in full view of the operator. Velocity and direction of spread is said to prevent material being carried by the wind.

A convenient lever controls the volume of spread by varying the forward travel



rate of the raddle drag. Rate of spread ranges from 2 to 14 loads per acre. Capacity of the box is 110 bu.

While spreading, the load moves forward to the front. This action keeps the load weight ahead of the spreader's two wheels and on the drawbar and tractor rear wheels. Two fully enclosed shredder beaters process all material delivered by the raddle drag. The upper beater has three bars and the lower beater has six bars. The raddle drag is driven by a roller chain. Chain travel is virtually continuous through a double ratchet drive.

The underslung axle of two channel steel members places the spreader box low, permitting the use of 7:50x24 tires on 8-in rims. The wheels roll on tapered roller bearings. The box is built of wood which is penta-treated against acid and water. Tongue-and-groove construction is used, with every board double-bolted to the steel frame.

Recirculating Drier Unit

The Habco Mfg. Co of Columbus, Nebr., has announced its new Model 400 grain drier—a drier and recirculating bin built as one integral unit. The unit burns LP-Gas and has a PTO drive. The bin has a capacity equal to 400 bu of shelled corn. The

unit is 15 ft, 11 in high; 7 ft, 5 in wide and 20 ft, 6 in long. Approximate weight is 5120 lb and capacity is 494 cu ft. The drying column is 18 in wide, constructed from perforated panels. A 2-speed discharge screw is used at low speed for recirculating grain through the bin and at high speed for unloading. The 36 in diameter, 8-blade fan is V-belt driven and has a maximum capacity of 39,000 cfm at recommended maximum speed of 1750 rpm.

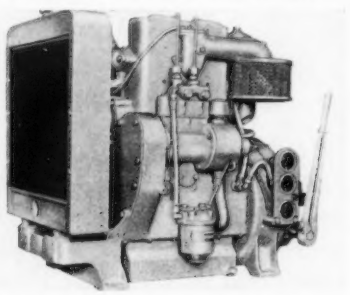
Self-Aligning Spherical Bearings

Southwest Products Co., 1705 S. Mountain Ave., Duarte, Calif., has announced production of a new line of self-aligning plain spherical bearings. Called SCB and SCBN series, the new bearings are said to

reduce lost motion in linkages and withstand excessive vibration. They are made of one-piece ball and one-piece race, and are available in sizes for 3/16-in to 1 7/8-in bore, with capacities of radial ultimate static loads from 3,000 to 152,700 lb.

New Two-Cylinder Diesel

R. H. Sheppard Co. of Hanover, Pa., has introduced its new Model 17A diesel engine as the latest addition to its line of power units and generating sets. The new model is said to be comparable in size, weight and price to many 20-hp gasoline engines, and was designed expressly to make possible use



of diesel power in many applications where its use was impractical before.

The new model is a 4-stroke, 2-cylinder engine. It has a 3½-in bore, giving it a 76.8 cu in displacement. The fan to flywheel unit measures 26-in high, 22¼-in long, less than 17-in wide and weighs 435 lbs. It is also offered as an open power unit, standard power unit and closed power unit, as well as a 5 to 7½-kw generating set.

Pocket Soil Penetrometer

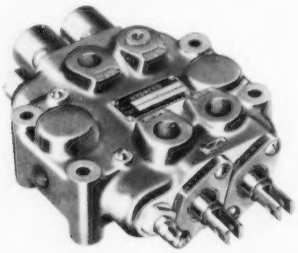
Soiltest, Inc., 4711 W. North Ave., Chicago 39, Ill., has developed a new direct-reading soiltest penetrometer for classification of soils. The device makes use of the penetration principle, and can be used for evaluating the shearing strength of soil on field exploration or construction sites and in preliminary laboratory studies.

In operation a piston is pushed into the soil up to a calibration groove machined on the piston. A pointer attached to a calibrated spring indicates the scale reading. The scale is direct reading in tons per sq ft or kilograms per sq cm.

Directional Control Valve

The Kalamazoo Division of the New York Air Brake Co., Kalamazoo, Mich., has announced the development of the Hydreco Series V-32 directional control valve for fluid power circuits. The new valve has been designed especially for applications on materials handling equipment, and other mobile units. It has an integral pilot-operated relief and unloading valve, and a parallel circuit affording simultaneous connection of the pressure port to any number of cylinders.

The manufacturer states that there are five models available, offering from two to



six operating plungers with rated capacities of 20 gpm. The recommended maximum operating pressure is 2,000 psi. The plungers are hydraulically balanced both axially and radially, and when the plungers are in the neutral position, the pump is unloaded.

An important safety feature is the hollow plunger which permits the use of a built-in check valve, eliminating load drop when plunger operating positions are changed. A special plunger, with all ports connected in neutral position, is available to permit free wheeling of fluid motors.

Molybdenum Steels Booklet

Climax Molybdenum Co., 500 Fifth Ave., New York 36, N. Y., has published a 4-page booklet, entitled "Moly Steels for Cast Gears." The booklet lists the advantages of molybdenum alloys which permit reduction in size and weight of cast-steel gears. It also explains the foundry practices and describes the physical and chemical properties of molybdenum alloy cast-steel gears and how hardness and strength are affected.

Chisel Plow

International Harvester Co., Chicago, has announced a new chisel plow, the McCormick No. 50, that consists of a tool-bar-type frame with two transport-depth control wheels, tractor hitch, and three cross beams. Silicon manganese steel spring shanks with either chisel points or sweeps are fastened to the beams.

The plow, equipped with chisels, can be used as a deep tillage implement, penetrating to a depth of 12 in. Equipped with sweeps, the plow can be used for surface cultivating or summer fallowing.

The new plow is available in 7, 10, and 13-ft widths. Each of these sizes can be widened 4 ft by using 2-ft extensions on each end. *(Continued on page 564)*

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can supply all your instrument needs —from one manufacturing source!

Instruments and Gauges of All Types—Including Complete Drive Equipment—Designed, Engineered and Manufactured to Your Specifications!

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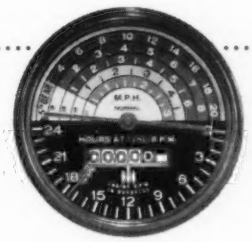
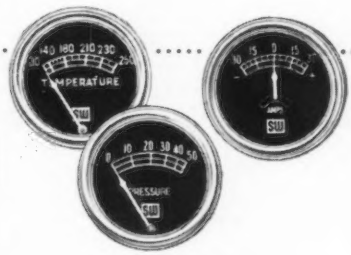
Stewart-Warner Custom-Built Panels

Panel illustrated is a complete instrument package with speedometer, tachourmeter, ammeter . . . water temperature, oil pressure and gasoline gauges. Typical of what Stewart-Warner can do to solve *your* instrumentation problem. Every job is custom-built to suit *you!*



Stewart-Warner Tractor Tachourmeter

Developed by Stewart-Warner especially for farm tractors. Top end of pointer shows tractor speed in miles per hour in the various gears. Lower end shows engine r.p.m. Odometer is calibrated to show hours of operation at governed speed. A practical unit for modern tractors.



Stewart-Warner Gauges

A complete line of heavy-duty gauges with mechanical or electric mechanisms, enclosed in dustproof, corrosion-resistant cases, with chrome trim and individual mounting brackets. Case sizes from 2″ diameter to $2\frac{19}{32}$″ diameter. A size and type for every purpose. Accurate, dependable!

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New Products and Catalogs

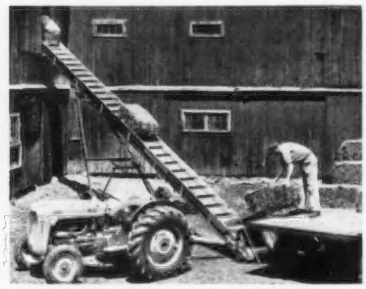
(Continued from page 562)

Electric Furnace Iron Folder

Belle City Malleable Iron Co., Racine, Wis., has published a new 4-page bulletin, entitled Belectric Iron, which lists advantages of electric furnace iron for applications where a gray iron of precisely controlled properties is required. This folder (No. 15 in a series) tabulates the principal physical properties of two grades of unalloyed and two grades of the alloyed gray iron. It is illustrated with photomicrographs of graphite distribution and examples of castings made from this type of iron. The material is prepared for the engineer, the buyer of cast parts, and anyone interested in the manufacturing of machinery or its components.

Adds Farm Elevator

The Tractor and Implement Division, Ford Motor Co., Birmingham, Mich, has introduced a new farm elevator. The new elevator is of galvanized steel construction, and available in lengths of from 30 to 60



ft. It features 20½-in wide trough with flights spaced 14-in apart on double chains. Roller bearings are used in the wheels and on the boot and head shafts, while angle iron trucks and a geared and sheaved lift assembly provide raising and transport.

Track-Type Tractor Literature

Caterpillar Tractor Co., has released the following literature describing the company's products:

Your Profit Insurance, an 8-page booklet, describes four component parts of track and final drive assemblies—sprockets, final drive seals, idlers and idler seals—and tells how they are made.

The Right Track, discusses track performance and development. Track link design, track shoes, track bolts and bushings are considered from a production viewpoint in an 8-page pamphlet.

DW20 Tractor and Equipment, a 2-color, 16-page booklet, contains information on performance and cost data of the DW20 tractor and matched equipment.

Cat-Built Bulldozers — The Answer to Profitable Earthmoving, an 8-page booklet, emphasizes the value and versatility of bulldozers in the earthmoving business.

Farm Tractors and Big Hitches, an 8-page booklet, discusses how farmers may get their work done quickly, economically and with less labor by utilizing big hitches to pull more implements.

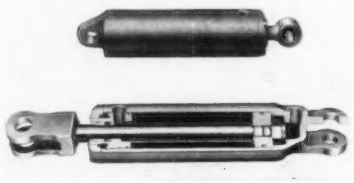
The Inside Story, an 8-page booklet, discusses the design, quality control and manufacturing skill involved in the production of track rollers.

These booklets may be obtained by writing Caterpillar Tractor Co., Peoria, Ill. Several of the booklets are available in Spanish, French and Portuguese.

Gland-Type Hydraulic Cylinders

Densmore Engineering Co., Inc., 235 E. Greenleaf St., Compton, Calif., announces the development of new double and single acting hydraulic cylinders which use a gland design and method of pre-stressing the snap-ring within the cylinder for streamlined design, easy maintenance and rod alignment.

Features of the new cylinders include chromed piston rods, aluminum alloy



pistons, V-ring rod packings independently adjustable, and bronze wiper ring on rods to keep out dirt. Cylinders are available from 2½-in through 4-in bore and from 1-in through 18-ft. stroke. They are designed for operating up to 1500 psi, and meet with ASAE standards for hydraulic cylinders.

Spray-On Lubricant

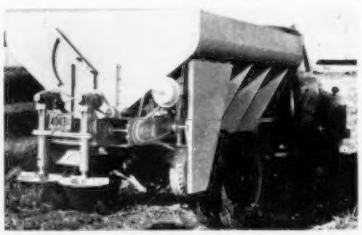
Electrofilm, Inc., P.O. Box 106, North Hollywood, Calif., has announced a new air-dry lubricant available in a spray-on, aerosol bomb. When sprayed on parts (both metallic and non-metallic) this resin base lubricant is said to provide a lubricant film which operates in a temperature range from −300 F to +500 F and for parts operating at high speeds and high loads.

According to the manufacturer, the lubricant dries in 30 min and can be used in conjunction with oils and greases where oil is necessary as a cooling agent, or it can be used without oils and greases when cooling is not a necessary function of the lubricant. Listed uses include application on gears, actuators, cams, hinges, pins, shafts, tracks, threaded parts, frictional bearings, pistons, cylinders, valves, and latches.

Lime and Fertilizer Bodies

Baughman Mfg. Co., Jerseyville, Ill., has announced a new line of lime and fertilizer bodies, identified as the K-5 series. The new bodies offer a choice of three types of conveyors and a selection of three drives.

The types of conveyors include: drag chain, 20 in wide, of malleable block chains



welded together with 4-in spaced cross drags; chain belt, 12-in wide; and belt, 20-in wide, with double corrugated drum. The drives consist of a PTO-driven distributor and conveyor; PTO-driven distributor and ground-driven conveyor; and a hydraulic motor-driven distributor and a ground-driven conveyor. All models are available in either double or single distributor, except the chain belt type which is available in single distributor only.

Roller Chain and Sprocket Book

The Link-Belt Co., has released a new 148-page book, No. 2457, describing its complete line of precision roller chain and sprockets. It includes sections on stock drives, drive chain, conveyor chain, installation and maintenance, lubrication, sprocket wheels, casings, and chain tighteners, among others. Thoroughly illustrated, this book gives all the information necessary to choose the right roller chain for a given application. Copies may be obtained from the Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.

New LP-Gas Tractor

International Harvester Co., Chicago, Ill., has announced a new tractor model, the International 300 LP-Gas Utility. According to the manufacturer this new LP-gas model provides approximately the same horsepower as the gasoline-powered model.

Features of the new LP-gas-operated tractor include a higher compression ratio, 12-

volt electrical system, micronic-type fuel filter, special carburetor, regulator-vaporizer unit, and a completely sealed fuel system with a special tank and controls. Filler connections and gauges, as well as operating controls, are mounted at the rear of the tank. Fuel tank capacity is 23.3 water-gallons, with an 80 percent LP-gas capacity of 18.64 water-gallons.

Plastic Silo Booklet

Bakelite Co., Division of Union Carbide and Carbon Corp., 260 Madison Ave., New York 16, N. Y. has published a booklet entitled, Plastic Silos and Silo Caps.

The 8-page booklet describes the use of plastic silo caps on open-top structures and by illustrations reveals the procedure of installing a silo made of plastic sheeting.

New Equipment Literature

Allis-Chalmers Mfg. Co., has released new literature covering farm equipment manufactured by the company:

TL-1567 is an 8-page booklet covering special attachments for All-Crop harvesters and Gleaner-Baldwin combines. They include the Navy bean, Spanish peanut and Western edible bean equipment, safety clutches, rear straw spreaders, traction drive hydraulic control, auxiliary low speed transmission, rubberized draper and rotary pickups.

TL-1556, an 8-page folder, presents a picture story of the Model 100 self-propelled All-Crop harvester harvesting a variety of grain, seeds, and beans in various sections of the United States.

TL-1577 is an 8-page folder covering the company's crawler tractor line for agricultural purposes, and deep-tillage implements designed for use with it including heavy-duty offset disk harrows.

TL-1533 is a 12-page compilation of owners' personal reports on tractors, tillage implements, cultivators, hay and forage machines, and combines.

(Continued on page 566)

BCA

BCA BALL BEARING PACKAGE UNITS

Cut Assembly Time and Costs

. . . Specifically designed for farm implement applications

Time-consuming installation problems are eliminated and costs come down when BCA pre-lubricated *package units* are used for ball bearing applications.

These BCA units combine the bearing, its housing, and an effective seal in a single rugged unit capable of handling the loads, speeds and operating conditions encountered in farm operations. The units are lubricated for life and are available for a wide range of applications in idler pulley assemblies . . . cam followers . . . plunger rollers . . . hay rake bearings . . . grain drills . . . and numerous others.

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Pioneers of pre-lubricated *package unit* ball bearings for agriculture

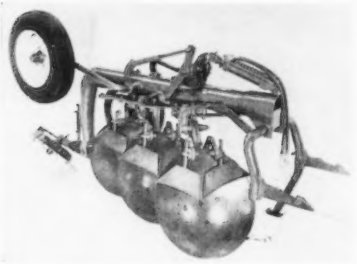
New Products and Catalogs

(Continued from page 564)

2-Way Disk Plow

International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., has developed a new 2-way disk plow that can be made to plow either right or left. The new implement is the McCormick 34-F301, a three-furrow disk plow, designed for attaching to Farmall 300 and 400 tractors equipped with two or three-valve hydraulic systems.

A hydraulic cylinder controlled by lever, changes the disk angle from right to left. Gauge and furrow wheels are repositioned



at the same time, and the plow is ready to plow the next furrow turning it in the same direction as before. If desired, the 2-way plow can be operated like any 1-way plow, turning the furrows only one way.

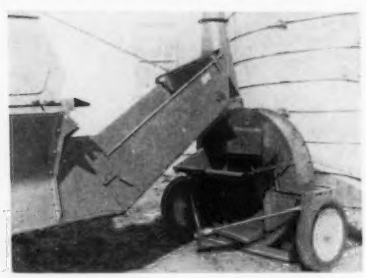
Each 26-in disk cuts an average width of 10-in and can plow to a depth of 10-in. A 21-in clearance between disks and a 30-in vertical clearance from the ground to the lower side of the stub beams are provided. Bearings are tapered roller type. Completely equipped, the plow weighs about 1,200 lb.

Dairy Booklet

Babson Bros. Co., 2843 W. 19th St., Chicago 23, Ill., has announced publication of a 14-page booklet, complete with illustrations in color, entitled, "Let's Get the Cows Off the Floor." This booklet is written to help dairymen cut labor and increase production through a greater output per man-hour of labor. Free copies are available by writing to Babson Bros. Co.

New Forage Blower

New Holland Machine Co., New Holland, Pa., has developed a new Model 21 hopper feed blower. It is designed for forage wagons having cross-conveyor unloaders. Wagons are pulled into position over the 18 x 32-in hopper for unloading. It



is reported that the capacity of the blower is up to 40 tons an hour. Standard equipment includes retractable steel wheels, 30 ft of 8-in pipe, tilt section and deflector. Optional equipment includes a two-speed PTO attachment and 15-in drop center rims for mounting standard rubber tires.

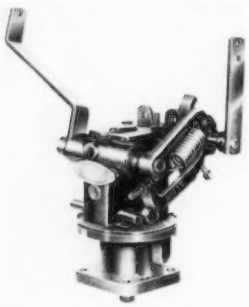
Self-Locking Fastener Catalog

The Nylok Corp., 475 Fifth Ave., New York 17, N. Y. has released a new catalog which describes its complete line of one-piece self-locking fasteners. The locking principle used in these fasteners consists of a tough nylon plug imbedded in the threaded section. It can be applied to any male or female threaded part, making a joint which reportedly resists being jarred loose by shock or vibration.

The catalog lists and describes the complete range of standard self-locking bolts and screws, set screws, hex nuts, threaded inserts, clinch nuts and cap nuts. Also described are numerous applications of special-purpose fasteners.

Governor For Torque Converters

The Pierce Governor Co., Inc., Anderson, Ind., announces the release of a new series of governors designed specifically for torque converter applications. The use of the fly-ball system in the governors reportedly provides control of tailshaft speeds throughout an extremely broad range in all types



of applications. Symmetrical in design, these governors are said to be adaptable to all converters having provisions for driving a governor directly, with a belt, or with a flexible cable. A new folder entitled "Pierce Governors for Torque Converter Applications." is available by writing to the company.

Equipment Catalogs

International Harvester Co., Chicago, Ill., has released a number of new catalogs dealing with tractors and equipment. These publications deal with the Cub Lo-Boy tractor, the No. 10 manure spreader, the new No. 161 self-propelled windrower, the 2 and 4-row corn listers, blackland planters, and the Hydra-Creeper attachment for Farmall 100 and 200 tractors.

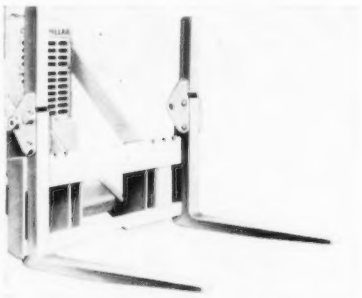
Catalog CR-368-F on the Cub Lo-Boy shows, in pictures, many of the jobs suited to this low-silhouetted tractor and its line of matched equipment. The self-propelled windrower, which uses 7 forward speeds that can be changed on the go, is described in catalog CR-281-F. The 45-bu, ground-driven manure spreader is covered by CR-347-F.

The 2 and 4-row corn listers, both Fast-Hitch and tractor-trailing for Farmall 200, 300, and 400 tractors and the International 300 Utility tractor, are described in publication CR-366-F.

One, two, and four-row forward-mounted blackland planters are discussed in detail in a new catalog, CR-302-F. Folder CR-208-F describes the Hydra-Creeper attachment for the Farmall 100 and 200 tractors and points out how it reduces the speed of the tractor to about 1/10 of normal speed in each gear permitting speeds ranging from approximately 1/5 to 1 mph.

New Log Attachment

Caterpillar Tractor Co., Peoria, Ill. has announced log and lumber fork attachments for models 955 and 933 Traxcavators. Each of the new fork attachments include a carriage which attaches to the lift and tip arms in place of the bucket. The tines are



mounted on this carriage and can be adjusted to three different spacings.

Adjustable standards, which can be set in either a vertical or a 35-degree forward position, are located at the top of the tines. Placed in the forward position, these standards keep logs from rolling over the back of the fork. The upright position is for handling of square loads such as stacked lumber or palletized loads.

V-Drive Sheave Catalog

Maurey Mfg. Corp., 2915 S. Wabash Ave., Chicago 16, Ill., will send, upon request, to interested readers a copy of a new catalog MVD-56. The new catalog describes the company's complete line and special made-to-order sheaves for multiple V-drives. It gives practical information on the handling of sheaves as well as dimensions and descriptions. Three pages graphically illustrate and describe the construction and the method of installing and removing sheaves and bushings. Additional pages inform the reader on straight or crowned face pulleys and on special made-to-order sheaves for A, B, C, D and E section V-belts. Brief data on the company's line of V-belts and V-pulleys are included.

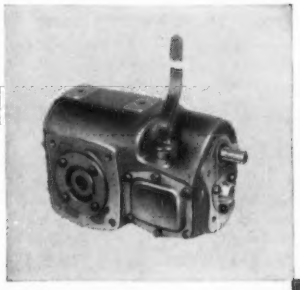
Pitless Well Adapter Folder

Merrill Mfg. Co., 8101 University, Des Moines, Iowa has published a bulletin which describes a pitless adapter for water wells to provide safety from contamination and protection from frost.

The pitless adapter is described as a length of pipe (slightly larger than the diameter of the well casing and varying in length according to local frost conditions) with a cast-iron housing at the bottom. This housing and its discharge opening are sealed to the well casing and the underground pipe system below frost depth. Inside the adapter is a lock pipe with a spool-like connector casting that straddles the discharge opening and prevents well water from going above the frost line to the surface. This connector casting is said to provide a watertight metal-to-metal seal. Drop pipes within the well are suspended from tthe easily removed lock pipe and spool.

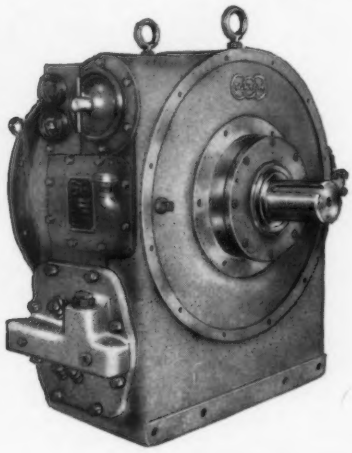
The pitless adapter is thus a device which in effect extends the termination of the well 13-in above the surface of the ground, yet provides an underground connection for well and water pipe system safely below frost level.

(Continued on page 568)



How to Make Sure of Superior Performance

CLARK-TORCON CONVERTER UNIT



Who can build the best machine!—that is the modern spirit of American Industry. And the intensity of that competition is a major reason why leading manufacturers are using Clark engineering cooperation in designing new equipment—highway and off-highway, automotive, industrial, and construction.

For *Clark knows the transmission of horsepower:* has specialized in that basic field for more than 50 years; knows what can be counted upon to work—and what will not . . . The drive-units pictured here were designed to *make sure* of superior performance. They are hard-working, rugged, dependable proofs that it's good business to do business with Clark Equipment.

Send for attractive pocket-size booklet "Products of Clark".

CLARK EQUIPMENT COMPANY
JACKSON, MICHIGAN
Other Plants:
Buchanan, Battle Creek, Benton Harbor, Michigan

CLARK® EQUIPMENT

New Products and Catalogs

(Continued from page 566)

Fluid Drive Booklet

American Blower Corp., Detroit 32, Mich., has released a new 2-page, 8½x11-in, illustrated, 2-color bulletin, No. 9719, describing the new size 126 type T Gyrol fluid drive for general industrial application. The new bulletin discusses construction features of the new design and illustrates typical industrial installations. Photographs show the basic unit for use with engine drives and the modified arrangement for electric motor driven applications.

Also included are installation type drawings giving basic dimensions and tolerances. Rating charts give the horsepower ranges of the new unit for various engine and electric motor drive speeds—from 7½ to 85 hp.

Welding Data Book

Eutectic Welding Alloys Corp., 40-40 172nd St., Flushing 58, N. Y. has released a new 176-page pocket data book describing welding procedures for every base metal. The book covers 120 welding rods, electrodes and welding compounds. It is a guide to torch and metallic arc welding, brazing and soldering. Useful information is given for fabrication, maintenance repair and salvage, overlaying for wear and corrosion resistance and welding of dirty, rusted parts. Special welding applications such as joints with high electrical conductivity, resistance to chemicals, tinning and plating are covered. Data is also given on methods of gouging, chamfering and removing of unwanted metal without special equipment. Weld preparation steps are given for all metals.

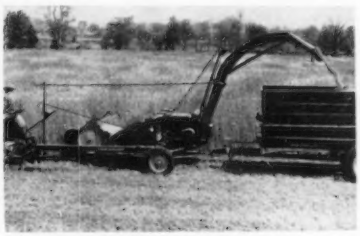
Flexible Shaft Bulletin

Stow Manufacturing Co., 39 Shear St., Binghamton, N. Y. will send on request a copy of its new engineering bulletin, No. 570, which illustrates typical installations using flexible shafting. It furnishes complete information on all sizes of shafting, from ⅛ to 1⅜-in in diameter, for either power drive or remote control applications. The correct size of flexible shaft for a particular application can be selected from helpful charts. Power drive shafts, with built-in bearings, and standard fittings and ferrules for connections where bearings can be eliminated are also shown in the bulletin.

Forage Harvester Features New Chopping System

New Holland Machine Co., New Holland, Pa., has announced a new field forage harvester, model 800, with a new chopping system. The new machine is said to have a capacity up to 45 tons of forage an hour. It is available with a 6 and 8-ft sickle bar, windrow pick-up, and one and two-row crop attachments.

The new model features a cutter head which both chops the material and blows it to a spout into a trailing wagon. Knives



are set straight on a cylinder at an angle so there is a shearing action as they pass the fixed cutting blade. A built-in knife sharpener sharpens the knives without being removed.

Two, three or six knives can be used to get lengths ranging from 5/16 to 2¼-in. The throat opening is 6½ by 20-in. All controls are telescopic to bring them into position for use from the tractor seat. The engine model has a 69-hp engine. A PTO-driven model is also available.

Variable-Speed Transmissions

Maureymatic Division, Maurey Mfg., Corp., 2915 S. Wabash Ave., Chicago 16, Ill., has announced a new line of variable-speed transmissions for providing speed adjustment for machines using up to 10-hp V-belt drives. The transmissions are available for factory assembly on new equipment, and for installation on machines already in service. Speed ranges up to 10 to 1 are provided.

With the new variable-speed transmission, the machine operator effects desired speed change by simply moving a speed control handle. There is no interruption in operation or production. The machine continues to operate while the speed change is made. When the desired speed ratio is attained, a turn of a pressure knob locks the transmission in position to hold the new speed ratio indefinitely. An automatic self-alignment feature keeps the V belts constantly in alignment.

Features and applications of the four styles of variable-speed transmissions are described fully in the new, illustrated Maureymatic catalog available on request to interested readers. *(Continued on page 570)*

do it with Air-Cooled
WISCONSIN ENGINE POWER

Koyker Auger Grain Elevator, powered by 4-cylinder V-type Wisconsin Power Unit. Made by Kooiker Mfg. Co., Hull, Ia.

Finco Portable Field Sorter and Finco Automatic Husking Bed, made by Finco, Inc., Aurora, Ill. All Finco equipment is Wisconsin-powered.

Haban dual-purpose Husker-Sheller (for field shelling or for use as a commercial unit), powered by 2-cylinder Wisconsin Engine. Made by Haban Mfg. Co., Racine, Wis.

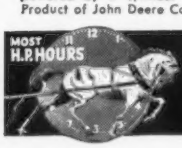
John Deere Model 14-T Twine-tie baler, powered by 2-cylinder Wisconsin Engine. Product of John Deere Co., Moline, Illinois.

When water boils away under a scorching summer sun . . . if the temperature should go up to an unbelievable and unbearable 140° F. — or if, on the other hand, it should drop to minimums way below the freezing point during an unseasonal cold spell — *there would be no cause for concern if your equipment is powered by a Wisconsin Heavy-Duty AIR-COOLED Engine!*

Wisconsin Engine AIR-COOLING is entirely automatic and as trouble-free as modern engineering ingenuity can make it. Every Wisconsin Engine from the smallest to the largest is equipped with a large capacity blower, integrally cast as a part of the flywheel. A powerful blast of AIR is continuously distributed over the closely-finned cylinder heads and walls by means of scientifically designed and placed air shrouding, providing correct heat dissipation at all temperatures up to 140° F.

In addition Wisconsin basic High Torque design and heavy-duty construction are assurance of steady-going operating dependability, low-cost maintenance and efficient, economical performance. All models can be equipped with electric starter and generator, or starter only, as original equipment.

There is no more rugged engine built, in a 3 to 36 hp. range, than a Wisconsin "AIR-COOLED" — which is a good reason why YOU should specify Wisconsin Power for your equipment. Write for "Spec" bulletin S-188.

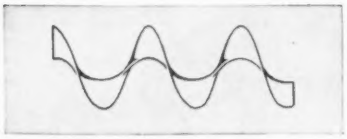


WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

How LINK-BELT makes it easy to **work augers into your design**

WHERE augers are a vital part of any equipment, here's the sure way to better equipment design. Link-Belt augers are available in a full range of diameters, gauges and pitches . . . in any suitable metal to meet your most exacting requirements. And they're simple and compact, accurately made to insure dependable operation.

For any design problem involving augers ask the Link-Belt office near you for engineering assistance.



SELECTED FLIGHTING for all your auger needs. Helicoid, sectional or a range of other types are available in the metal and finish best suited for your design.

SIMPLICITY OF CONSTRUCTION and sturdy design of Link-Belt augers provide dependable, efficient operation on your machine. One basic assembly — no other moving parts to break down.

The complete auger, for gathering cut grain back of the sickle bar, is furnished by Link-Belt for this harvester-thresher.

YOUR CHOICE OF METALS answers your requirements for handling corrosive or abrasive materials. And Link-Belt uses only specially selected steels.

ENGINEERING SERVICES. Our auger specialists will help to analyze your special needs . . . integrate all elements of your design for overall system efficiency.

ALL COMPONENTS — conveyor screws, collars, couplings, hangers, troughs, trough ends, flanges, drives—are available for every design.

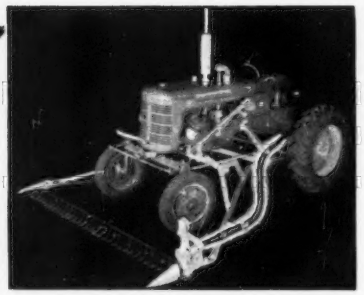
LINK-BELT

FARM MACHINE AUGERS

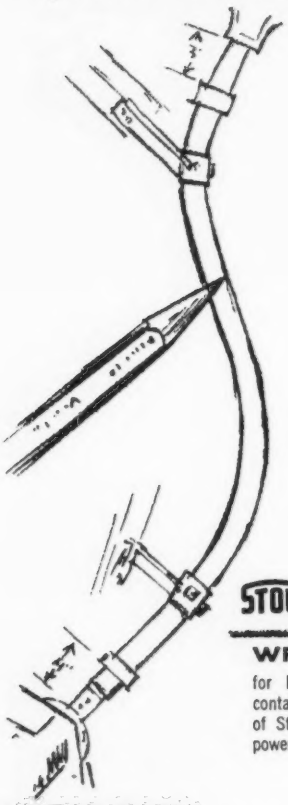
Get in touch with the nearest Link-Belt office for your copy of Screw Conveyor Data Book 2289 . . . today.

14,052

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.



picture of a
design engineer
who **had** a
power transmission problem



Know who this fellow is?

We'll tell you*, but first, here are the facts about the power transmission problem he licked with STOW flexible shafting.

Briefly, this company had the problem of supplying power to a mower on a farm tractor, from the tractor's power take-off which was 7 feet away. Raising and lowering the mower further complicated the problem because of the relative motion introduced between the ends of the shaft. Further, the drive used had to be dependable, economical, easy to maintain and safe.

*This Krengle's Inc. engineer found the answer in STOW flexible shafting. 1-inch shafting, with specially designed end terminals, was used for this job.

STOW your problems—

WRITE TODAY

for Engineering Bulletin 525 containing detailed information of Stow Flexible Shafting for power drives and remote control.

STOW

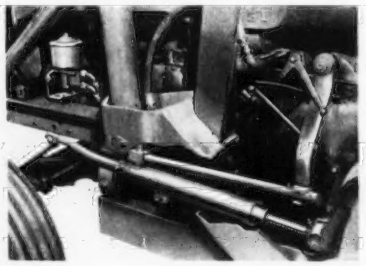
MANUFACTURING CO.
Originators of the Flexible Shaft
39 Shear St., Binghamton, N. Y.

New Products and Catalogs

(Continued from page 568)

Power Steering Unit

Sherman Products, Inc., Royal Oak, Mich., has announced a new hydraulic power steering unit for attachment to the Fordson-Major diesel tractor. The new power steering device comprises a combination hydraulic servo valve and cylinder that is actuated by the pitman arm of the tractor steering column, and the power to operate this



combination is supplied by a self-contained pump and reservoir unit, driven by a V-belt from the generator pulley on the tractor.

This unit is said to be adaptable to the Fordson-Major tractor with all combinations of industrial and agricultural attachments, and eliminates side thrusts and shocks which normally tug at the steering wheel.

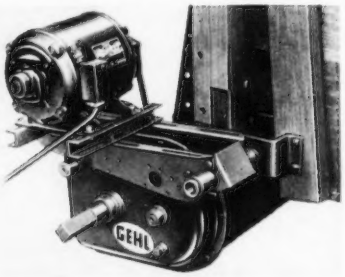
Hydraulic Systems Bulletin

Vickers Incorporated, Detroit 32, Mich. has released a new 20-page, 8½ x 11-in, 2-color, illustrated catalog describing oil- hydraulic systems and components for all mobile equipment in the truck and bus, construction machinery, material handling, agricultural and allied industries.

The new catalog contains discussions of performance characteristics, design features, construction details and applications for the company's line of single and double vane pumps, power packs for mobile equipment, multiple unit valves, relief valves, reservoirs, fluid motors and power steering boosters.

Wagon Jack

Gehl Bros. Mfg. Co., West Bend, Wis., has introduced a new lightweight, electric motor-driven, wagon unloading jack. The WJ-84 wagon jack is compact, quickly and easily attached or detached from the wagon and has convenient handles for lifting. The



company reports that 4 tons of forage can be unloaded in less than 10 min. The jack without motor weighs less than 60 lb and no stakes are needed. Male ends extend on both sides so that the jack can be used on either side of the wagon. Bronze bearings are used throughout. All gears run in oil and are totally enclosed in an all-steel gear box.

(Continued on page 572)

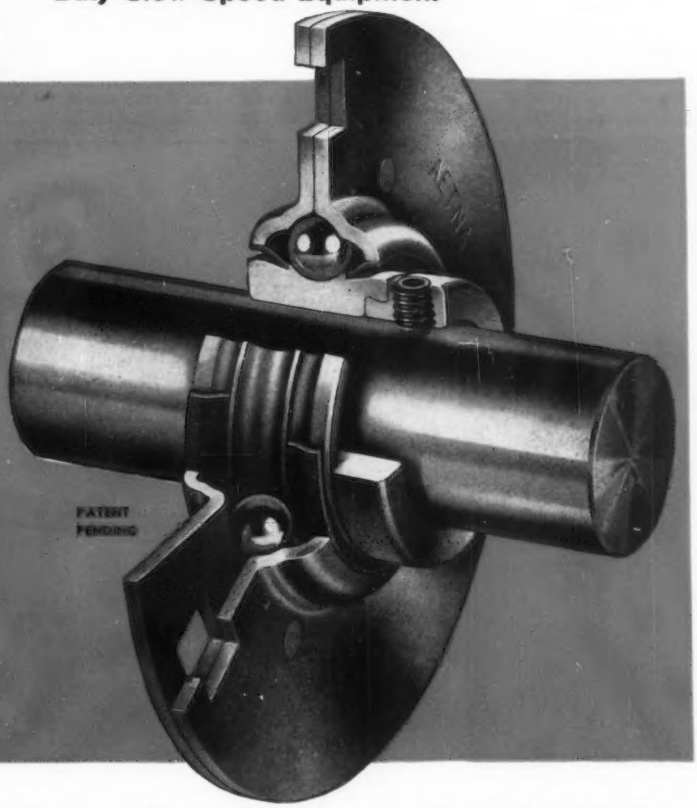
THE NEW AETNA ADAPTER BEARING

A Complete, Single-Package Ball Bearing Unit That Brings Low-Cost, Anti-Friction Efficiency Within The Range Of All Light-Duty Slow-Speed Equipment

You're looking at the better BUDGET bearing . . . the new Aetna AG-Series Adapter Bearing . . . keyed to the cost problems of light-duty slow-speed equipment designers.

In this one thrifty *package* you get a complete, compact, easy-to-install ball bearing unit . . . adaptable to an amazing variety of machine and equipment applications. It can be mounted wherever shafts can be supported . . . on sheet metal or any other economical, semi-rigid structural members. Pre-lubricated and uniquely sealed it assures long, dependable, trouble-free operation with minimum servicing.

Check and compare the Aetna Adapter Bearing features below. Chances are you could write this unit into YOUR specs with attractive cost-reducing product-improving results. Mail coupon today!



SAVES MONEY
SAVES TIME
SAVES SPACE

FEWER PARTS • Simplified, compact, space-saving design. Flange and outer bearing race—ALL-IN-ONE. Full ball complement. No retainer.

EASY MOUNTING • *Package* construction—needs no pre-installation adjustments, fitting or reassembly. Eccentric locking collar for easy, quick mounting without auxiliary positioning devices, without shaft shouldering or machining.

PRE-LUBRICATED • Generous, factory-packed lubricant chamber assures maximum life and operating efficiency, minimum servicing.

EXCLUSIVE SEALS • Dirt-proof, leak-proof, one-piece Buna-N seals (of Aetna-originated design) are self-contouring, free-running, self-aligning, corrosion and rust-free; provide positive contact under all conditions of misalignment.

SELF-ALIGNING • Compensates for shaft or structural member deflections and misalignment. Takes radial, thrust or combined loads.

RUGGED DURABILITY • Inner and outer races case hardened for high fatigue and shock load resistance. Heavy gauge pressed steel housing.

OTHER AETNA LOW-COST BEARING UNITS

Sprocket Idler Unit

Belt Idler Unit

Grain Drill Unit

Disc Harrow Unit

Aetna

BALL BEARINGS
ROLLER BEARINGS
MISCELLANEOUS PARTS

AETNA BALL AND ROLLER BEARING CO.
Div. of Parkersburg-Aetna Corp. • 4600 Schubert Ave • Chicago 39, Ill.
Please send bulletin 5678 detailing your new line of low-cost mounted ball bearing units

Name_____
Company_____
Address_____
City_____ Zone_____ State_____

New Products and Catalogs

(Continued from page 570)

Product Manual

Amplex Division of Chrysler Corp., Detroit 31, Mich., has released a new product manual listed as the E-56 Engineering Manual. The book is thoroughly revised from previous years and contains complete details about the company's products. It includes data on properties of materials and it lists Brinell and Rockwell ratings for these materials.

The 52-page manual contains a special 12-page insert which lists over 1,000 standard sleeve, flange and thrust bearings, cored, solid bar and plate stock, available for shipment in any quantity.

Mounted Bean Harvesters

International Harvester Co., Chicago 1, Ill., has introduced a new line of bean harvesters for the Farmall 200, 300, 400, and Super C tractors. One of the new machines is the McCormick 234C-26, a 2-row harvester capable of handling 28 to 32-in rows on nonirrigated land. The other is the 234C-46, a 4-row harvester for 20 to 28-in rows on either irrigated or non-irrigated land. In non-irrigated fields, 30 and 32-in rows also may be harvested.

An attachment for adapting the 2-row machine to harvesting beans grown on irrigated land is available. Also, an attachment is available for converting the 4-row harvester into a 6-row machine.

In operation a steel blade runs underground to cut the tap root of the bean plant while vine-turning rods lift the bean vines from the soil and guide them into a single windrow for the 2-row harvester and two windrows for the 4-row harvester. These new bean harvesting implements mount on cotton and corn or on beet and bean cultivator front frame units.

The company also makes a 2-row bean harvester that mounts on the Farmall Cub, 100, or Super A tractors. This machine is adapted to use on 28 to 30-in rows on non-irrigated land.

ELECTRIC
Wheels Engineered for the Job
WRITE US FOR RECOMMENDATIONS
Rear Tractor Wheel for Demountable Rim
Planter Press Wheel—one piece rim with or without rubber tire
Pick-up Wheel Crown-face Steel Rim
Rear Tractor Wheel Reversible
Combine Wheel Reversible
Garden Tractor Wheel Reversible
Press and Gage Wheel Rubber Tire
Spreader Wheel
SAE Implement Wheel Reversible
ELECTRIC WHEEL COMPANY
2806 SPRUCE · QUINCY, ILLINOIS

Loop Hook Electric Fence Post

Tosco Enterprises, 4155 W. Bath Rd., Akron 13, Ohio, announces a new electric fence post which features an insulated wire-enclosing top loop. The new post is constructed from springy cold rolled ⅜-in steel round rod, and features stepped design for installation without digging tools. Rough polyvinyl insulation covers the hot wire enclosing loop at the top. The insulated curl is said to provide non-slip, non-grounding grip of electric fence wiring.

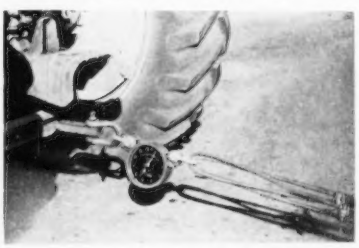
Safety Light

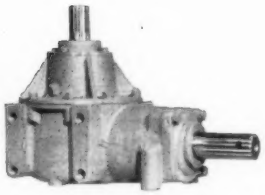
International Harvester Co., Chicago 1, Ill., has announced a red and amber safety light adapted for mounting on tractors and on various implements. The single light, amber in front and red behind, is mounted and carried on the tractor, unless the tractor is transporting an implement. Then the light can be removed from the bracket on the tractor and mounted on the implement in such a location as to be visible from both front and rear.

Twenty-two feet of electric cord with a breakaway connection comes with the attachment and permits the light to be moved from one location to another. Special mountings are available for different implements.

Drawbar Pull Dynamometer

W. C. Dillon, Inc., 14620 Keswick St., Van Nuys, Calif., has developed a new traction dynamometer which indicates in pounds the amount of drawbar force exerted. The units are available in ranges, from 0-500 up to 0-100,000 lb. All models come completely equipped with maximum pointers, shatter-proof crystals, and clevises and pins. Either 5 or 10-in dials are optional for ranges up to and including 20,000 lb. with 10-in dials as standard for 30, 40, 50 and 100,000-lb capacities.





Field or Brush
Cutter Gear Box

Going around in circles on

GEAR BOX PROBLEMS?

Combine
Gear Box

Hay Baler
Gear Box

Field or Brush
Cutter Gear Box

Turn them over to Warner Automotive

If you're looking for the answers to gear box problems, look to Warner Automotive! You'll save time, avoid needless expense, end frustration. And chances are you'll get just what you want—at lower cost than you probably think.

Warner has pioneered the design, engineering and precision production of gear boxes for field or brush cutters, hay balers, forage harvesters, spreaders, combines, corn pickers, post hole diggers, hammer mills. Our research has licked problems you may now be facing. And our specialized manufacturing facilities are more than adequate to meet your production schedules.

So why not make that exploratory call right now! Our people are anxious to help—and there's no obligation.

WARNER
QUALITY FEATURES

- Automotive type gearing
- Carburized and hardened alloy gears
- Anti-friction bearings throughout, individually selected for load
- Integrally forged gear and shaft, wherever possible
- Malleable iron housings
- Laboratory and field tested

ENGINEERING B-W PRODUCTION

WARNER AUTOMOTIVE PARTS DIVISION
BORG-WARNER CORPORATION
AUBURN • INDIANA

"PRODUCTS OF EXPERIENCE"

NEW BOOKS

Chemistry and Uses of Pesticides (Second Edition) by E. R. deOng. Cloth, vii+334 pages, 6x9 inches. Illustrated and indexed. Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $8.75.

This book gives information on insecticides, fungicides, herbicides, rodenticides, repellents and seed disinfectants with data on chemical and physical properties, toxicology and compatability.

Almost half the book is devoted to detailed instruction on the use of synthetic compounds, many not previously listed. A dictionary of 500 compounds shows the chemical and common names with brief, functional definitions. Authorized tolerances for pesticides are listed as well as those requiring none or zero tolerances. Advances are covered in all branches of pesticides. This book should be a great help to agricultural chemists, pesticide manufacturers, agronomists, food processors, farmers and students.

Geology and Ourselves, by F. H. Edmunds. Cloth, 256 pages, 6x9 inches. Illustrated and indexed. Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. $10.00.

This book shows the importance of geology in our everyday lives. After a preliminary outline of the broad principles of geology, the author explains how the geologist can deduce the subterranean contents and structure of the land from observation made on the ground surface, or from a study of the geological map.

Engineering projects, such as tunnels, are dealt with, and it explains how the geologist can help the engineer to anticipate and avoid dangers. The comparatively new studies of geophysics, geochemistry and soil-mechanics are introduced. An account of the relation between rocks, soil and agriculture covers the preparation of soil maps, and the place of geological data in industrial planning is brought out.

Electrical Interference, by A. P. Hale. Cloth, vii+122 pages, 5x7½ inches. Illustrated and indexed. Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. $4.75.

This book has been written from a practical point of view and should be of great help to electrical engineers and radio and television servicers. It covers the causes of interference; the effects of interference; receiver aerial systems; measurement of interference levels; location of sources of interference; avoidance of interference; basic filters; safety; practical filters; and Faraday cages. An important feature is a series of photographs of a television screen showing the effects on the picture of different types of interference.

Atoms and Energy, by H. S. W. Massey. Cloth, 174 pages, 5½x8½ inches. Illustrated and indexed. Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. $4.75.

This book gives a non-technical account of the developments in atomic physics which led up to the large scale release of atomic energy. The similarities and differences between the atomic processes which occur in ordinary combustion and in nuclear fission are explained in order to realize the immensity of the new power available. The consequences of this for war and peace are discussed.

Although the relation of atomic research to atomic energy forms the central subject of the book, special attention has been paid to the nature of the research methods used in modern physics. The final chapter gives an account of the researches going on at present to elucidate the nature of the fundamental particles. The way in which atomic energy is converted to heat in the sun and stars is also described.

Manual of Electric Pumping by Electricity Supply Department, State Electricity Commission of Victoria. Composition cover, 112 pages, 5½x8½ inches. Illustrated and indexed. Electrical Development Division, 238 Flinders St., Melbourne, C. 1, Australia.

The book was written to present in simple form only fundamental principles, explanations and essential data for the efficient use of electricity for pumping. Chapters cover types of pumps, pressure systems, installation and care of pumps, pumping problems, belt drives, motors and controls, typical problems and solutions, and hydraulic data. The types of pumps included centrifugal, axial flow, mixed flow, reciprocating, rotary, plunger, ejector, turbine and submersible.

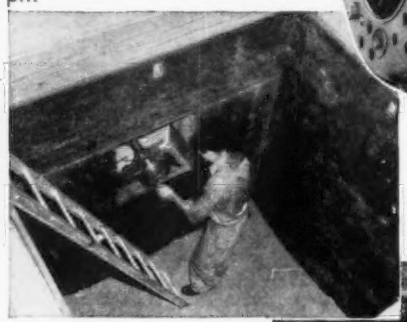
The Generation of Electricity by Wind Power, by E. W. Golding. Cloth, xvi+318 pages, 5½x8½ inches. Illustrated and indexed. Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. $12.00.

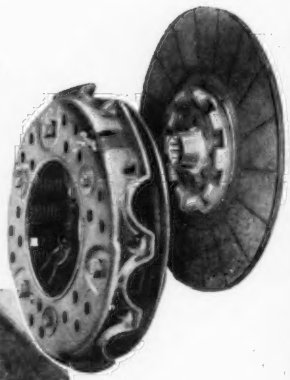
The book deals with the important matter of wind surveys for the choice of suitable sites, with the structure and behavior of the wind and techniques for measuring it. It considers the economy of wind power in relation both to large public supply networks and to isolated premises and communities. It includes an interesting study of the use of wind power through the ages, a full account of present-day activities, and a survey of future prospects. This book will be of interest to all concerned with the provision of electric power and to engineering students in universities and technical colleges.

ROCKFORD

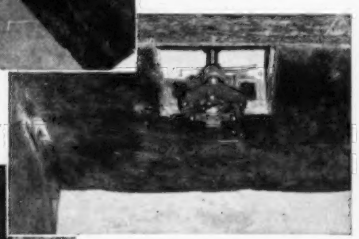
Clutches Are Spin Strength Tested to Meet The Needs of Modern High Speed Engines

First they are put in a deep, armor-plated, concrete test pit.

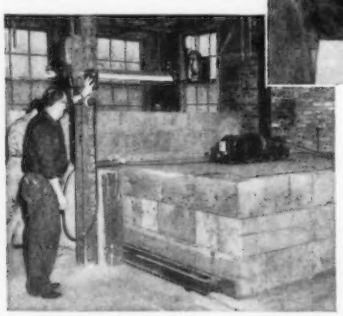


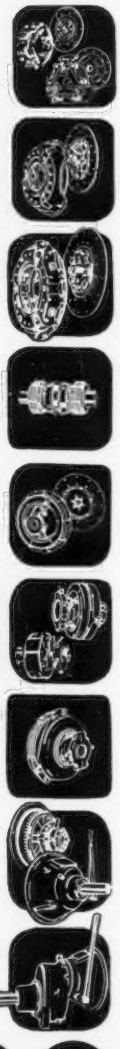


Then fastened on a shaft that spins the clutch at high speed.



The clutch is spun, and highest R.P.M. recorded.





Let us help insure fully-tested clutches for YOUR products.

ROCKFORD
Clutch Division
BORG-WARNER
1325 Eighteenth Ave., Rockford, Ill.

CLUTCHES

FOR SMOOTH ROLLING

STRICK TRAILER CHOOSES ATLAS CHAIN FOR EASIER OPERATION OF STRICKROOF

An easy turn of the handle and the roof of this Strick Trailer slides forward or backward with the help of Atlas Roller Chain. The Trailer can be loaded from the top as an open van, the roof rolled back and it is ready for the road. Its easy action is typical of Atlas Chain because each and every part is precision-made for smoother action and extra service.

Long life starts with Atlas specially selected steels. Plates, pins and bushings are super-toughened by heat treating and the Ni-Carb process which give a stronger, better operating chain over longer periods.

Rollers, pins and bushings are "Micro-Finished" to exact tolerances. Sprockets heat treated for toughness are precision-ground for smooth, quiet operation with Atlas Chain. Both the chain and the sprockets are carefully pre-tested at more than 30 points in production to assure you of chain unsurpassed in quality and performance. Whatever your chain or sprocket need, call on Atlas. Write for Atlas Chain and Sprocket Handbook ARC-56 to Atlas Chain & Manufacturing Co., West Pittston, Penna.

ATLAS

ROLLER CHAIN AND SPROCKETS

NEW BULLETINS

The Three-Team Method of Picking Apples, by J. H. Levin and H. P. Gaston. Michigan Agricultural Experiment Station (East Lansing) Article 38-65 (June, 1956).

In the three-team method of picking apples, a ground crew a mid-section crew, and a top crew with appropriate equipment are used. The number of workers in the various crews are regulated in such a way that they move through the orchard at about the same rate. Rates at which apples were picked by crews using the conventional system and the three-team method were compared. Similar comparisons were made when various combinations of equipment were used. Results revealed that the three-team system makes it possible to increase the average rate at which apples can be picked; to lower the total per-bushel cost of picking; to use to good advantage specialized equipment; and causes less fruit to be bruised and knocked off the tree. Limitations are also listed.

When You Need A Water Well, by The National Water Well Association, P. O. Box 222, Urbana, Ill. The 8-page booklet was written to acquaint the public with proper procedure in securing a safe and dependable water supply. The folder discusses some facts to help select a well-drilling contractor and includes other problems such as, how much water is needed; where the well should be located; how the correct pumping equipment is selected; and some rules to follow to insure getting a good water supply.

MARSH GAUGES

with the stamina it takes for agricultural use

Here are your kind of gauges. They bring you not only that time-honored Marsh precision and accuracy, but also a proven ability to stand up and stay accurate under toughest conditions.

In the Marsh Type AA series you have the one line of pressure gauges designed expressly for agricultural ammonia applications. And in the broad, respected line of Marsh Gauges you will find the best answer to any crop sprayer or other pressure gauge needs.

Note the accompanying facts covering Marsh Gauges; then

Ask for Complete Details

MARSH INSTRUMENT COMPANY

Sales affiliate of Jas. P. Marsh Corporation,

Marsh Instrument & Valve Co. (Canada) Ltd.,
8407 103rd St., Edmonton, Alberta, Canada

60 lb. ammonia gauge

Designed for Agricultural Ammonia Needs

These gauges typify the Marsh Type AA series of 2½" gauges:

A 60-lb. and 150-lb. gauge for ammonia metering devices — both have *accurate* one-pound readings.

A 300-lb. and 400-lb. gauge for bulk plants. Also compound gauges — 30" x 150 lbs. and 30" x 300 lbs.

All Type AA gauges are corrosion resistant throughout, moisture and dust resistant, easy to read, and, above all, built for *lasting* accuracy.

CROP SPRAYER GAUGES

This Marsh Type IDP is suitable for any pressure medium that will not deteriorate brass. Ranges for all sprayer applications. In the broad Marsh line there is a gauge for every service.

400 lb. ammonia gauge

Vermiculite Fire-Resistance Ratings, by Vermiculite Institute, 208 LaSalle St., Chicago 4, Ill. The 8-page bulletin includes fire ratings obtained with vermiculite plaster, acoustical plastic and concrete. Details of fire-proofing are contained on columns, beams, girders, trusses, ceilings, and plaster over wood construction.

A discussion on fireproofing ceilings reports that tests have indicated that vermiculite plaster ceilings protected primary members as well as secondary members and that fire ratings were the same when a vermiculite plaster ceiling is furred, in contact or suspended from primary members.

71 Home Projects in Wood, by the National Lumber Manufacturers Association, 1319 18th St., N.W., Washington 6, D. C. (Price 35 cents) Although the bulletin was prepared especially for the novice handy man, it includes projects for the real beginners, the intermediate, and the more advanced home handyman. A feature of the publication is that every project uses standard lumber grades and sizes available at any lumberyard. It contains simplified drawings and a complete list of the materials needed for building many useful home-and-garden items.

Proceedings of the Fourth Annual Dairy Engineering Conference by Carl W. Hall and A. W. Farrall. The 89-page bound report contains copies of papers given at the Fourth Annual Dairy Engineering Conference held at Michigan State University, March 13 to 14, 1956. (Price $2.00). Subjects of papers contained in the booklet cover hold-over plates; cold storage doors; checking performance of refrigeration; treatment of dairy wastes; water pollution control legislation; packaging and filling problems; measuring flow of milk; floor-type conveyor and automatic stacking; automatic casers; new devices for automation; materials handling; safety in delivery truck; and cold sterilization. Papers on measuring the flow of milk reported on radioactivity gauging and sanitary, magnetic and ultrasonic flow meters.

Simplex Grain Drying and Storage Silos, Report No. 122, by National Institute of Agricultural Engineering, Wrest Park, Silsoe, Bedfordshire, England. The 32-page bulletin reports the drying performance, drying rates, power consumption, and depression of germination in an installation of seven bins disposed in one row of four 10-ft diameter bins and a parallel row of three 12-ft, 6-in diameter bins. Ventilating air is supplied by two actual flow fans, one at each end of an air duct running at right angles to rows of bins; two branch ducts running below rows of bins connect intake duct with the ventilating cylinder in each bin. The bins were formed from curved panels of galvanized expanded metal mounted on steel frames.

1952-1955 Illinois Drought With Special Reference to Impounding Reservoir Design, by H. E. Hudson, Jr. and W. J. Roberts. State of Illinois Department of Registration and Education Bulletin 43, 1955. The 52-page report includes a section that outlines the history of the hydrologic and water supply deficiencies that arose during 1952-55 in Illinois. This history is followed by a brief discription of the work needed to keep track of the situation. A summary of the normal situation, an analysis of the water-supply problems that arose, and the hydrologic characteristics of the drought are included. Data assembled in studying the drought were found to be useful for design studies and the report concludes with the presentation of the application of these data to impounding reservoir design.

Stainless Steel Helps Farmers solve the work and sanitation problem of handling many small cans every day. Stainless steel tanks like that shown above make the bulk milk system practical. They permit storing milk for two days without danger of contamination from the metal. Yet they are easy to clean despite the 2-day storage. This tank holds milk at 35°F. Transferring milk from tank to pick-up truck takes about 10 minutes at the Braley farm, Bangor, Maine.

Farmers protect purity of milk and save work by using stainless steel tanks

Here's a 500-gallon chromium-nickel stainless steel tank that brings several advantages to Ernest Braley, owner of 40 Holsteins.

First, purity of milk is protected because stainless chromium-nickel steel resists attacks by food acids, steam, water, atmosphere and also by cleaning solutions. Thus, no corrosion products are given off that may affect either purity or flavor of the milk. Moreover, the dense surface of chromium-nickel stainless can be readily polished to a smooth finish which offers no harbor for bacteria or other contaminants.

And, this tough, rugged metal is easy to clean and keep *hygienically* clean. Unlike metals that corrode and pit, stainless steel saves the dairy farmer considerable work. His routine scrubbing, washing and rinsing take less effort. And less time.

Stainless steel is not only a sanitary metal, it's also a tough metal that stands rough usage. Even abuse. So start using it now for dairy and allied equipment. Leading steel companies produce austenitic chromium-nickel stainless steels in all commercial forms. We'll be glad to help you select exactly the right type of stainless for your specific needs. Send us details of your application for our suggestions.

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WITH **UNITCASTINGS!**

We make no *special* claims to produce miracles with cast steel. Like competitive foundries, problems are similar . . equipment may differ slightly . . it's the *end performance* of the casting that counts!

A little *extra* surveillance in process pays off quality-wise. Customers receive better, cleaner castings . . meeting accepted specifications . . and end up with a lower *finishing* cost. Less scrap . . less re-work . . and less lost production time amounts to more than incidentals!

Standard carbon and low alloy steel castings, up to 150,000 psi tensile . . whatever your requirements, specify Unitcastings!

UNITCAST CORPORATION • Toledo 9, Ohio

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Unitcast

QUALITY STEEL CASTINGS

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Arras, Orlen E.—Ditching contractor, RR 1, Mason, Mich.

Barker, Alexander V.—Agricultural consultant, Puget Sound Power & Light Co., Mt. Vernon, Wash.

Bennett, Arthur H. — Agricultural engineer, Marketing Research Division (AMS) USDA (Mail) Barrow Hall, University of Georgia, Athens, Ga.

Chaffin, Robert H. — Farmer, RR 1, Ithaca, Mich.

Clark, John H.—Fieldman, Kemptville Agricultural School (Mail) Mountain, Ont., Canada

DeMull, Earl—Owner and operator, Earl DeMull Farm Trenching Service (Mail) RR 2, Coopersville, Mich.

DeMull, Harold — Owner and operator, Harold DeMull Farm Trenching Service (Mail) RR 2, Lowell, Mich.

DeMull, Richard G.—Owner and operator, DeMull's Trenching Service (Mail) 609 Center St., Coopersville, Mich.

Finch, Vance B. — Agricultural engineer (SCS) USDA (Mail) 1606 W. 24th St., Pine Bluff, Ark.

Franz, James F. — Patent examiner, U.S. Patent Office, Washington, D. C. (Mail) 3320-16th St., N. W., Washington 10, D. C.

Haynes, David W. M.—Head, Department of Agriculture, Kuala Lumpur, Federation of Malaya (Mail) Workshop and Pool, Serdang, c/o Sg Besi, P.O. Malaya

Halverson, Lloyd H.—Estimator-draftsman, architectural department, Potlatch Yards, Inc., P.O. Box 2148, Spokane 4, Wash.

Holdren, Donald R. — President, Holdren Brothers, Inc. (Mail) Box 306 West Liberty, Ohio

Kuehn, Lawrence J.—Owner and operator, Kuehn Construction, 125 N. Maple St., Fowlerville, Mich.

Lucas, Bobby J.—Engineering assistant, Virginia Electric & Power Co. (Mail) 35 E. Walnut St., Alexandria, Va.

Richards, Chester L.—Field product engineer, Whitney Chain Co., 237 Hamilton St., Hartford 2, Conn.

Soderstrom, Jack F.—Owner and operator, Soderstrom Trenching Service, RR 1, Sparta, Mich.

Turner, Carl J.—Assistant agricultural engineer, Clemson Agricultural College, S. C.

Urie, Walter L. — Agricultural engineer (SCS) USDA (Mail) Westford, Vermont

Van Doren, Cornelius A. — Project supervisor, (ARS, SWCRB) USDA (Mail) 403 West Vermont, Urbana, Ill.

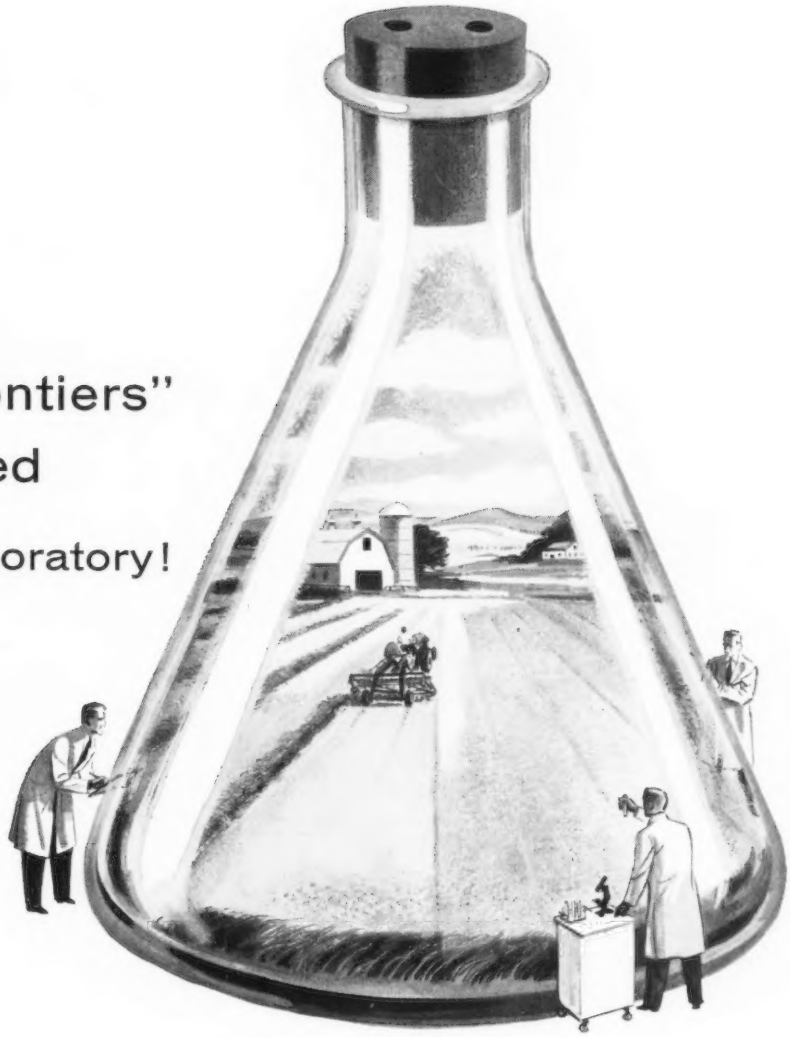
Ward, Gilbert C. — Owner and operator, Ward Trenching Service, RR 1, St. Johns, Mich.

Wilson, Elra L.—Superintendent, irrigation operations, Salt River Valley Water Users' Assn., P.O. Box 1980, Phoenix, Ariz.

Transfer of Membership

Coleman, Joseph L.—Field engineer, Massey-Harris-Ferguson, Ltd. (Mail) 15 Embro Dr., Downsview, Toronto, Ont., Canada. (Affiliate to Member)

Now these "wild frontiers" are tamed in the laboratory!



Some specialists say grasses and legumes are now at about the same stage of development as open pollinated corn was 50 years ago. It is generally conceded that *most* of the improved varieties grown today are selected from the "wild."

Take the standard time-tested Sudan grass, introduced shortly after the turn of the century. Recent introductions of Sudan grass, such as *Piper*, *Tift*, and *Lahoma*—all of which are now disease-resistant—show what research can do.

But it's only the beginning. So far only a small portion of the more than 6,000 known species is used. The vast number of unstudied grasses holds a treasure of desirable characteristics that could be "bred out" into usable grassland plants.

The scientists who search for new germ plasm and transfer and blend it from grass to grass—legume to legume—are staking out a new frontier. They're insuring the future of grassland farming by improving crops *today*.

New Holland, in turn, plans and builds new and improved grassland machines to handle today's bigger and better crops. And always with an eye to future demands of grassland mechanization.

There's a great future for young engineers at New Holland. To find out more about us, write: New Holland Machine Co., New Holland, Pa.

NEW HOLLAND
"First in Grassland Farming"

PERSONNEL SERVICE BULLETIN

NOTE: In this bulletin the following listings current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this Bulletin, request form for Personnel Service listing.

POSITIONS OPEN—JANUARY—O-534-790. FEBRUARY — O-4-602, 6-603, 29-606. MARCH — O-60-608, 60-609, 71-611,80-612. APRIL—O-115-614, 117-615, 117-616, 119-617, 127-618. MAY—O-133-620, 155-621, JUNE—O-165-623, 166-624, 166-625, 167-626, 159-627, 142-628, 173-629, 175-630, 179-631, 181-632, 181-633. JULY—O-183-634, 189-635, 180-636, 198-637, 215-638, 216-639.

POSITIONS WANTED—1955—DECEMBER W-489-58, 480-59. 1956—JANUARY—W-457-60, 528-61. FEBRUARY—W-8-1, 18-5, 30-6, 37-7. APRIL W-50-11, 90-13, 96-14, 43-15, 53-16. MAY—W-125-17, 139-18, 143-19. JUNE—W-161-20, 122-22. JULY — W-190-23, 193-24, 214-25.

NEW POSITIONS OPEN

AGRICULTURAL ENGINEER, assistant or associate rank, for research in farm drainage in experiment station of a north central state. Age, under 40. MS deg in agricultural engineering, or equivalent, preferred. Other qualifications considered. Research experience in soil and water field highly desirable. Good health. Ability to work with others. Honest desire to do research work. Excellent opportunity for advancement in new, well-supported program. New building. Adequate travel allowances. Good retirement program in addition to social security. Salary open. O-233-640

INSTRUCTOR in mechanical technology to teach in an eastern agricultural and technical institute. May be required to teach in areas of industrial materials and processes, elementary physical metallurgy, testing and inspection of engineering materials, and applied mathematics and science. BS deg in mechanical engineering, metallurgy, or equivalent. Experience 3 to 5 yr in industry and/or teaching. Opening to be filled as soon as possible. Opportunity to prepare graduates of two-year curriculum for employment in manufacturing, engineering laboratory assisting, and design. Salary open. O-234-641

AGRICULTURAL ENGINEER, to teach soil and water subjects and some machinery in southeastern land grant college. Age under 35. BS deg in agricultural engineering required. MS deg, and/or experience preferable. Desire to teach and ability to work and cooperate with others. Excellent opportunity for qualified person. Salary open. O-219-642

AGRICULTURAL ENGINEER, instructor, to teach in a western polytechnic college. Must be able to teach in four of the following five subjects: farm tractors, farm power, farm machinery, carpentry and concrete, and arc and acetylene welding. Age 25-30. BS deg in agricultural engineering, with emphasis in the power and machinery field. Farm background and experience in operation, repair and servicing of equipment. Able to work well with young students and inspire them thru enthusiasm and ability. Excellent opportunity in growing school. Salary $4296 to $5772. O-217-643

AGRICULTURAL ENGINEER for extension work in broad range of subject matter, with special effort in harvesting, processing, structures and farm machinery in a Western County. Age 25-35. BS deg in agricultural engineering from a recognized school. MS preferred. Must have ability to work with associates and farm people. O-239-644

AGRICULTURAL ENGINEER, associate professor for teaching and some research in a college of agriculture and mechanic arts in a Latin-American area. Age, under 45. MS deg in agricultural engineering, PhD preferred. Teaching and/or research experience. Usual qualifications for college teaching. Knowledge of Spanish not necessary, but interest in the language is desirable. Good opportunity for advancement. Salary open. O-240-645

AGRICULTURAL ENGINEER, assistant professor, for research on irrigation and possible teaching at a land-grant university. MS deg in agricultural engineering or equivalent. Usual personal qualifications for college research and teaching. Yearly automatic raises and merit raises. Starting salary $5,000 minimum. O-241-646

AIR POLLUTION CONTROL OFFICER, for work in a county in Southern California. Age 35-45. Engineering graduate with some work in chemistry and meteorology. Experience 4 yr in air pollution, industrial hygiene, public health engineering or similar field. Good appearance, tact, ability in public speaking, working with others, analysis, and management. Good opportunity in top position in program subject to development. Salary $647 per month to start. O-244-647

AGRICULTURAL ENGINEER, instructor or assistant professor rank, for research and teaching professional and agricultural mechanics courses in agricultural processing and related rural electric applications. Research 75 percent, teaching 25 percent. Eastern state university. BS deg in agricultural engineering, or equivalent. Able to get along with students and staff. Good opportunity for advancement, and for work toward MS deg. Salary open. O-262-648

AGRICULTURAL ENGINEER for irrigation field in a western state university and agricultural experiment station. Research $\frac{3}{4}$ time, teaching $\frac{1}{4}$. Age under 35. MS or PhD in agricultural engineering. Experience in irrigation engineering and teaching desirable. Pleasing personality. Able to work with others. Good health. Academic advancement in university and experiment station through performance and accomplishment. Position to be filled by September 15 if possible. Salary $5400-6000. O-246-649

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER for design and development in farm power and machinery with manufacturer or distributor, preferably in Southeast. Single. Age 29. No disability. BS deg in agricultural engineering, 1951, Michigan State University. Design experience one year on tillage equipment; field testing 4 yr all types of farm equipment, with large manufacturer. Available Aug. 15. Salary open. W-282-26

LOWER COST, LESS WEIGHT *with this*

NAGEL-CHASE PRESSED STEEL PULLEY

This Tractor Power Take-Off Pulley is another example of savings made when Nagel-Chase redesigns a part for pressed steel construction. Originally made of cast iron, the problem of redesigning it was turned over to Nagel-Chase engineers. The result—a *substantial reduction in weight and cost!*

This pressed steel pulley was designed in two halves, with beaded rims, that are riveted to an iron hub. After extensive tests, it was found equal or superior to the cast iron pulley in strength and performance and eliminated a number of machining operations. It is now being manufactured for production by Nagel-Chase for a farm equipment manufacturer.

You may have a similar problem where any part, not necessarily a pulley, could be redesigned in pressed steel with substantial savings. There is no obligation when you consult Nagel-Chase, specialists in pressed-steel manufacture.

NAGEL-CHASE MANUFACTURING COMPANY

2815 North Ashland Chicago, Illinois

Who Should Join ASAE

If any one of the following descriptions covers your present work:

- Development, design, and application of farm tractors and implements and their components
- Design and improvement of farm buildings
- Engineered improvements for soil and water conservation and use
- Creating applications for electricity in farm practice and living—

then you can derive much benefit from membership in ASAE, and the Society cordially invites you to make application. For further information write

AMERICAN SOCIETY OF
AGRICULTURAL ENGINEERS
St. Joseph, Michigan

the BADGE of him who BELONGS

DESPITE the *presumption* it sets up, mere membership in the American Society of Agricultural Engineers is no *proof* of a man's high rank in technical talent. It does prove that he has met certain minimum requirements and has earned the esteem of colleagues who sponsored his application for membership.

But the Society emblem is *evidence* that native talent, be it great or small, is enriched by fraternity with the personalities whose minds fuse to form the pattern of progress in the methods and mechanics of agriculture. The wearer of the emblem waits not for the debut of an idea, but is present at its birth and helps to guide its growth.

Be you novice or veteran, your membership in the organized profession adds something to your efficiency, your vision, your influence as an individual engineer. The Society symbol on your lapel is token that you "belong". Wear it.

STYLES AND PRICES OF ASAE EMBLEMS

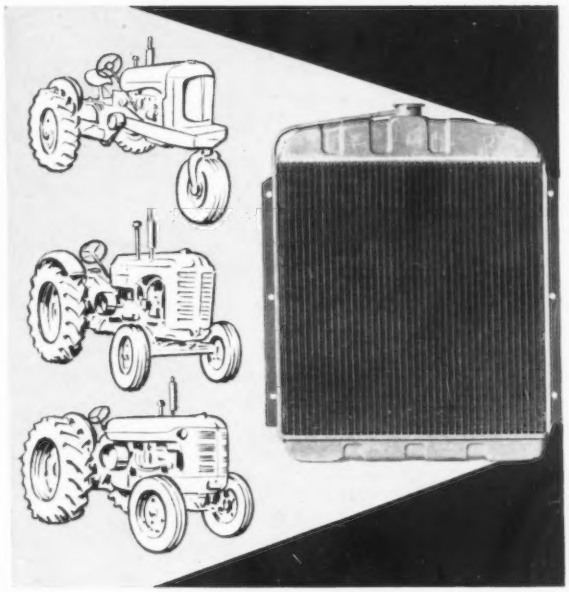
With blue ground for Fellows, Members, and Associate Members — furnished either in pin with safety clasp or lapel button — $3.50 each.

With red ground for Affiliates — furnished only in pin with safety clasp — $3.50 each.

Send orders to ASAE, St. Joseph, Michigan.

Young Radiators

are used where the going is tough



Tractor makers specify Young to get the strongest radiator structure known

With matters of great technical importance—in business, professions or industry—appropriate action is most often entrusted to *experienced specialists*. So it is among leading tractor manufacturers. These leaders know that Young engine-cooling radiators are designed, developed, built, tested, re-tested and proven by heat transfer specialists.

The rigorous conditions under which tractors must operate demand radiators of Young *quality*—high-strength radiators with restraining core side baffles, corner web reinforcing and many other exclusive structural features. Over rough, broken terrain, with big loads, under varying speeds, and high and low temperatures, tractor radiators must be able "to take it." Good reasons why "Young radiators are used where the going is tough."

Put Young Talent to work for you . . .

Solving heat transfer problems is what we do best because it is our very reason for being. You, too, can harness the power of Young engineering talent. Write, wire or call without obligation.

Write
Dept. H-296
for FREE Catalog

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS FOR INDUSTRY
Heat Transfer Products for Automotive, Aviation and Industrial Applications. Heating, Cooling, Air Conditioning Products for Home and Industry.
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

You Can't Beat
GALVANIZED
Roofing & Siding

FOR BEST VALUE, buy *Grade-Marked* sheets, which show weight of zinc coating. And for longer, stronger service, specify heavy-coated roofing and siding such as the "Seal of Quality" . . . With *galvanized* sheets, you get the *strength* of steel, the *protection* of zinc. Preferred by thousands of users. Proved by time itself. Feature by feature, they're your *best buy.* Check and compare with any other material!

ZINC INSTITUTE 2 OZ. COATING SEAL OF QUALITY

	GALVANIZED SHEETS	ANY OTHER MATERIAL
STRUCTURAL STRENGTH and rigidity; withstand rough treatment	YES	
YEARS OF RUST-FREE SERVICE; little or no upkeep problems	YES	
EASIEST TO HANDLE, lay and nail; stay put, hold at nail-holes	YES	
LIGHTNING PROTECTION, fireproof, ratproof, pleasing appearance	YES	
LOW COST ALL THE WAY, to buy, to apply and thru the years	YES	

FREE! "DO-IT-YOURSELF" MANUALS

Write: AMERICAN ZINC INSTITUTE
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Lafayette, Indiana Dept. AE8

☐ Facts About Galvanized Sheets
☐ How To Lay Galvanized Sheets
☐ Metallic Zinc Paint for Metal Surfaces

NAME_____
ADDRESS_____
CITY & STATE_____

News Section

(Continued from page 558)

Two Elected ASAE Fellows

THE Council of ASAE recently elected Arthur W. Farrall and Dwight D. Smith to the grade of Fellow in the Society.

ARTHUR W. FARRALL was born in Harvard, Nebr. in 1899. He attended Nebraska Wesleyan University for pre-engineering and received a B.S. degree in 1921 and an M.S. degree in agricultural engineering in 1922, both from the University of Nebraska. In 1955 he received an honorary degree of doctor of engineering from the University of Nebraska.

His first job after college in 1922 was with the University of California as a junior agricultural engineer. In 1928 he became assistant professor where he did teaching and research in the field of dairy machinery and equipment. Beginning in 1929, for three years, he worked with the Douthitt Engineering Co. in Chicago where he was director of the spray drying laboratory. His work dealt with the desiccation of milk and food products. In 1932 he accepted a position with the Creamery Package Mfg. Co. in Chicago as research engineer and director of research. Here he invented and developed a number of important items of dairy equipment, such as ice cream freezing equipment, milk pasteurization equipment, refrigeration equipment, homogenization equipment, and equipment for a continuous butter manufacturing process.

In 1945 he became head of the department of agricultural engineering at Michigan State University. Since that time the department has grown from a staff of 16 to approximately 50. A new agricultural engineering building has been constructed and the department was accredited by the ECPD in 1950. He was responsible for initiating and was general chairman of the "Centennial of Farm Mechanization" that was held at Michigan State University in 1955. He served as chairman of the general arrangements group for entertaining the annual ASAE meeting in 1948 and will serve as chairman of the local arrangements group for the Golden Anniversary ASAE Meeting to be held at Michigan State University in June, 1957.

He served as chairman of the Chicago ASAE Section in 1945 and was a member of the eleven man delegation from the United States to the 12th International Dairy Congress held in Stockholm, Sweden, in 1949, as an engineering representative. He was chairman of the college division of ASAE in 1948.

He holds patents on several machines that have been used in the dairy industry. He is author of a college text book, entitled Dairy Engineering, and is author or co-author of over 30 bulletins and technical articles.

DWIGHT D. SMITH was born in Orangeville, Ill., in 1905. He received a B.S. degree in agricultural engineering from Kansas State College in 1928. From June 1928 until September 1929, he was enrolled as an industrial sales trainee with the Westinghouse Electric Mfg. Co. He resigned this position and joined the agricultural engineering department at the University of Missouri as an instructor where he taught courses in farm power and machinery. In addition he conducted research on silo filling methods, hay drying, fertilizer placement and farm power and machinery costs in crop production. He also assisted with the building and testing of new types of terracing equipment. In 1931 he received an M.S. degree in agricultural engineering from the University of Missouri.

In 1933 he became camp superintendent, first at the ECW camp at Princeton, Mo., and later at Brown Branch, Mo. As superintendent he planned and administrated field work on gully control on forestry projects. In 1934 he resigned this position to become project engineer for the "Big Creek" watershed soil erosion control project at Bethany, Mo. Here he was directly responsible for the engineering work on one-third of the 225,000-acre project. In 1939 he was transferred to headquarters at Columbia, Mo., so that he could continue to direct the research work at Bethany and develop a research program for the claypan soils on the McCredie Station. Here he furnished the first basic data used in compiling the initial draft of the degree of slope, length of slope and erosion characteristics now used in farm planning procedures. He developed new cropping systems for the claypan soils and raised the fertility of these soils to where they are now considered among the most potentially productive soils in the state.

On the basis of his earlier experience with the problems of terrace layout, construction and operation, he conducted one of the earliest Midwest studies on the problem of straightening terraces, and has recently developed an equipment "production equation" for enabling field technicians to determine the relative production rates to be expected with various types of field terrace layouts.

In addition to his regular duties, he has always been particularly active in working as special consultant on various erosion control problems in his area. In 1953, he helped make a special survey of the terracing problems in the Plains States.

Mr. Smith is author or co-author of over 25 bulletins, technical publications, and miscellaneous reports. He has served on various soil and water committees of the American Society of Agricultural Engineers and has been an active member of the American Geophysical Union. He is a licensed professional engineer in the state of Missouri.

NECROLOGY

Myron V. Stevens, drilling and excavating contractor, Mitchell, S.D., was killed in an automobile accident, May 30.

A native of South Dakota, Mr. Stevens was born May 18, 1919 at Mitchell. He attended the South Dakota School of Mines, Dakota Wesleyan University and graduated from South Dakota State College with a B.S. degree in agricultural engineering, 1949.

Immediately after graduation he and a fellow graduate formed a partnership, purchasing a trenching and a well-drilling machine. With this equipment they installed complete farm and ranch water and sanitation systems. A few months later he became sole owner.

Walter McNab Miller, assistant professor of agricultural engineering, University of Wyoming, Laramie, was killed in a dynamite explosion, July 20. He and two other men had been planting sticks of dynamite for blasting out a spring to increase the water flow. It was reported that Mr. Miller evidently had a piece of dynamite in his hands and had capped it, and when he tested the wire it blew the dynamite.

Mr. Miller was born in New York City in 1918. He studied mining engineering at the University of Kansas for three years and transferred to Kansas State College in 1939 from which he received a B.S. degree in agricultural engineering. He served in the Air Force for four years and on his release attended Washington State College, graduating in 1948 with an M.S. degree in agricultural engineering. After his graduation he accepted the position he held at the time of his death.

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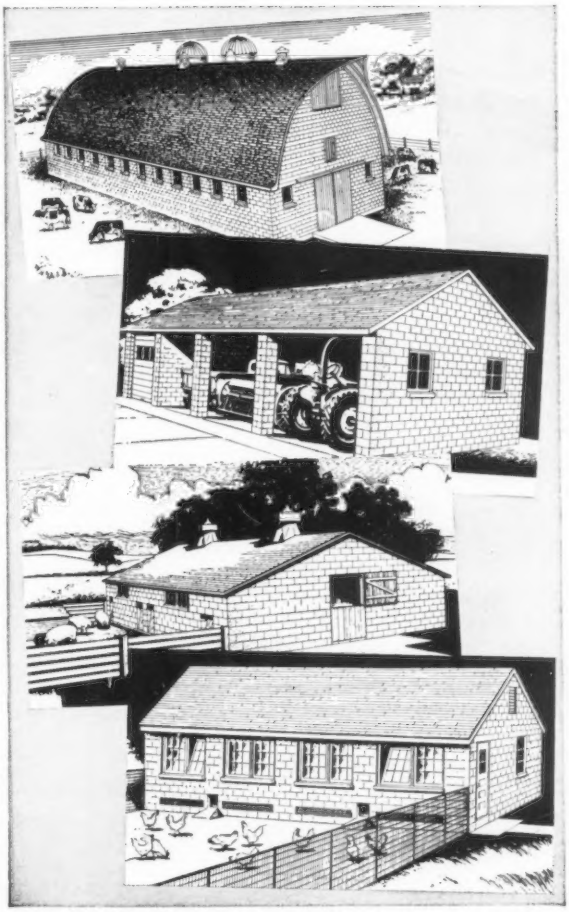

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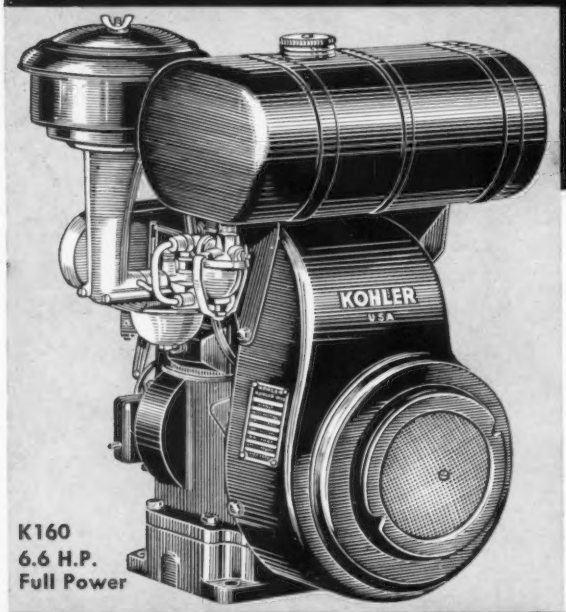

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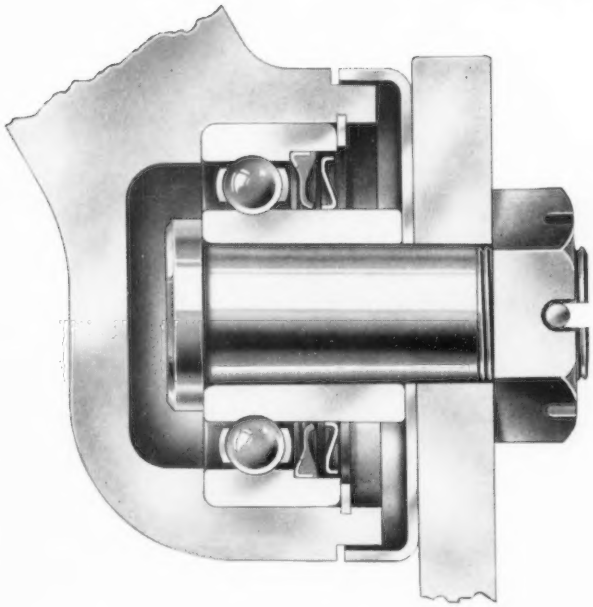

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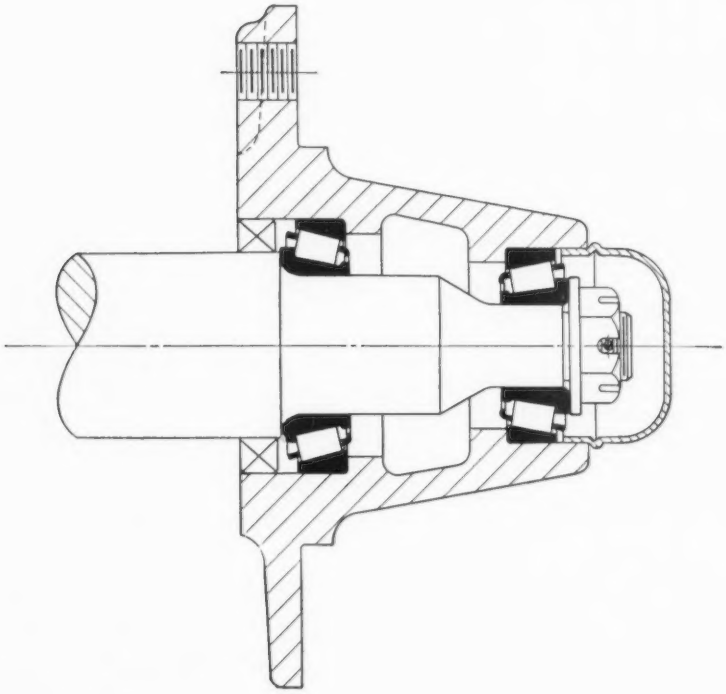

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